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THE PHYSIOLOGY OF MIND.

THE

PHYSIOLOGY OF MIND.

BEING THE FIRST PART OF A THIRD EDITION,
REVISED, ENLARGED, AND IN GREAT PART REWRITTEN,
OF "THE PHYSIOLOGY AND PATHOLOGY OF MIND."

BY

HENRY MAUDSLEY, M.D.

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PREFACE.

THE first edition of my work on the *Physiology and Pathology of Mind* was published in the year 1867. A second edition appeared in the following year, which was in due time exhausted, and the book has been out of print for some years. The delay in the publication of a third edition has been owing mainly to the occupations of active professional life, which have hindered the bestowal of the systematic work of revision and enlargement made necessary by the progress of physiological and psychological knowledge; but partly also to a lack of enthusiasm in the labour, arising from a conviction that what was of value in the book had either been said already, or would anyhow very soon be said, by some one else. The current of psychological thought having set so strongly in physiological channels, it is pretty certain that the reflections which one person has had, however original they may seem to him, some other person has had, has now, or will very soon have. One is happily, too, more critical, as well as less enthusiastic and confident, at forty than at thirty years of age; and a result of the more sober mood is that what seemed very important, and much needing to be said, at the earlier date, does not seem of so much consequence, or anywise to press for delivery, at the later date.

There was another inhibitory reflection, occasioned by a contemplation of the revolution in psychological method, which has been going on for some time now, and of the entirely different aspects which many psychological questions have assumed in consequence. The changes that have taken place have been so great and so rapid that a book written ten years ago must necessarily, unless re-written, be much out of date now.

In the preface to the first edition, the aim of the work was declared to be twofold: "first, to treat of mental phenomena from a physiological rather than from a metaphysical point of view; and, secondly, to bring the manifold instructive instances presented by the unsound mind to bear upon the interpretation of the obscure problems of mental science—to do what I could to put a happy end to the 'inauspicious divorce' between the Physiology and Pathology of Mind." The way in which the fulfilment of the first part of this twofold aim was prosecuted did not fail to provoke much criticism, of the direct and indirect sort, from those who assumed that it was a reckless attempt to discard entirely the psychological method of inquiry into mental phenomena, and to employ the physiological method exclusively. No doubt the energetic exposition of the shortcomings of the psychological method and the earnest advocacy of the physiological method lent some countenance to that supposition, but it was none the less directly contrary to the distinct enunciation of that which was advocated in the first chapter as the proper method of the study of mind, and with the method actually pursued in the execution of the work throughout. It was not possible to set forth adequately the fruitfulness and the rich promise of the physiological method, and to elevate it to its rightful position, without exposing the shortcomings of the psychological method, and degrading it to a lower rank than that which it had usurped.

The physiological method has made such great way that it stands not now in need either of defence or advocacy; and the result cannot fail to be, as regards this book, that the exposition of its merits, made with all the vehemence of youthful enthusiasm, must look like a superfluous assertion of claims which are not seriously contested, while the record of acquisitions which have become part of the general body of thought certainly requires not the aggressive prominence which it had.

To adapt this edition in some measure to these new conditions, I have, while incorporating the entire substance of previous editions, omitted or modified various expressions and passages which seemed objectionable as they stood, and have sought to maintain the level of a more sober style; and, in order to bring it even with the present state of knowledge, the original matter has been carefully revised and largely added to. The consequence has been that what was the First Part of former editions, treating of the Physiology of Mind, and had been written in the first instance in order to lay a foundation for the Second Part, which dealt with the Pathology of Mind, has grown so much, and attained by its growth such an independent character, as to render it advisable to make it a separate volume.

This volume is, then, presented as a treatise on the physiology of mind, and may stand on its own account as such, quite apart from the second volume which, following in due season, will be occupied entirely with the pathology of mind, and with the accomplishment of the second part of the twofold aim. Or, if it be thought too ambitious a thing to call it a treatise, let it be looked upon as a disquisition, by the light of existing knowledge, concerning the nervous structures and functions which are the probable physical foundations, or the objective aspects, of those natural phenomena which appear in consciousness as feelings and thoughts, and are known only in that way—that is to say, subjectively. Should any one choose to declare that the book is neither Physiology nor Psychology, but an ill-conceived medley, and be offended at what is offered to him, I am not careful to answer in that matter; I am more wishful, in my unwisdom, that it should be in conformity with nature than with the divisions of sciences which he and those who think with him labour to impose upon nature by way of amendment upon its continuity and unity. It may not be amiss perhaps to caution the reader that he allow not the book to obtain by implication, either from physiology or from psychology, more authority than it is fairly entitled to; I desire only that it may stand on its own bottom as an exposition of the aspects, be they right or wrong, in which the author's study and reflection have led him to view the matters which are discussed in its pages.

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THE
PHYSIOLOGY OF MIND

CHAPTER I.

ON THE METHOD OF THE STUDY OF MIND.

> "Ich sag' es dir: ein Kerl der speculirt,
> Ist wie ein Thier, auf dürrer Heide
> Von einem bösen Geist im Kreis herum geführt,
> Und rings umher liegt schöne grüne Weide."
>
> *Faust.*

THE right estimate of his relations to external nature ha ever been to man a matter of difficulty and uncertainty In the savage state of his infancy he feels himself so little in the presence of nature's vastness, so helpless in conflict with its resistless forces, so overawed by the spectacle of its serenely inexorable course, that he falls down in abject prostration before its various powers The earth of a sudden heaves beneath his trembling feet and his shattered dwellings bury him in their ruins; the swelling waters overpass their accustomed boundaries and indifferently sweep away his property or his life; the furious hurricane ruthlessly destroys the labours of years; and famine or pestilence, regardless of his streaming eyes and piteous prayers, stalks in desolating march through a panic-stricken people. In the deep consciousness of his individual powerlessness he falls down in an agony of terror and worships the causes of his sufferings: he deifies the powers of nature, builds altars to propitiate the angry Neptune, and, by offering sacrifices of that which is most dear to him, even his own flesh and blood, hopes to mitigate the fury of Phœbus Apollo and to stay the dreadful clang of his silver bow. When the army of the King of Assyria, coming up against Jerusalem to destroy it, is devastated by pestilence, it is the angel of the Lord which goes out in the night and smites in the camp of the Assyrians an hundred fourscore and five thousand, so that they are all dead corpses in the morning. In like manner, when any case of sudden death occurs now among the Bongos of Central Africa, it is some old woman who has allied herself with the witches to do evil, for it is deemed certain that a strong man would not die unless he were bewitched.* Everything appears supernatural when man knows nothing of the natural; palsied with fear, he cannot observe and investigate; himself he feels to be insignificant and helpless, while to nature he looks up with awe-struck apprehension as mysterious and almighty. Reflect on the fearful feelings which any apparent exception to the regular course of nature—the appearance of a comet, the occurrence of an earthquake or of an eclipse—even now produces in many uncultivated minds, on the superstitious dread which follows such unfamiliar event, and it will not be difficult to realize the extreme mental prostration of primitive mankind.

Through familiarity, however, consternation after a while subsides, and the spirit of inquiry follows upon that of reverence; the prostrate being rises from his knees to examine into the causes of events. Experience, sooner or later, reveals the uniformity with which they come to pass; he discovers more or less of the laws of their occurrence, and perceives that he can by applying his knowledge avoid much of the damage which he has hitherto suffered—that he can, by attending to their laws, even turn to his profit those once dreaded physical forces. Now it is that man begins to feel that he has a much higher position in nature than in his infancy he had imagined; for a time he looks upon himself as belonging to the same order as the things around him; and he emancipates himself in great part from the dominion of the priests in whom he had hitherto believed as the sacred propitiators of the gods whom his fears had fashioned. When his creeds are seen to spring from an imperfection of intellect, the prayers founded on them are abandoned as marking an imperfection of will.

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* Schweinfurth's *Heart of Africa*, vol. i. p. 310. When the North American chief Picheto was one night much alarmed by the violence of the storm, he got up and offered some tobacco to the thunder, entreating it to stop.—TANNER, *Narrative of a Captivity among the North American Indians*, p. 136.

Thales of Miletus is said to have been the first who, in this advance amongst the Greeks, laid aside the priestly character and stood forth as a pure philosopher; and those who immediately followed him, and constituted the Ionian school of philosophy, having an instinctive feeling of the unity between man and nature, did seek objectively for a first principle of things—the ἄρχη—common to him and the rest of nature. This slow and tedious method was soon, however, abandoned for the easier and quicker method of deduction from consciousness: abstractions were made from the concrete by the active mind; and the abstractions being then projected out of the mind into objective realities, were looked upon and applied as actual entities in nature. Anaximander, diving into his own mind and finding something inconceivable there, gave to it the name of the Infinite, and, transferring it outwards, was thenceforth content to pronounce it to be the true origin of all things; whilst Pythagoras, going perhaps still further into the unmeaning, proclaimed numbers, which are mere arbitrary symbols, to be actual existences and the essences of things.

Thus it was that man, forgetful of his early humility, rose by degrees to the creation of a god after his own image, and to the construction of the laws of an external world after the pattern of his own thoughts: he worshipped a god who was of like passions with himself, suspicious, jealous, revengeful, kindled to anger by neglect, appeased by praise and sacrifice, while such motives as he felt to influence his own actions were held also to be the principles governing the relations of external objects; natural phenomena being explained by sympathies, loves, discords, hates. As the child attributes life to the dead objects around it, speaking to them and thinking to receive answers from them, so mankind, in the childhood of thought, assigned its subjective feelings to objective nature, entirely subordinating the physical to the metaphysical: it was but another form of that anthropomorphism by which the Dryad was placed in the tree, the Naiad in the fountain, Atropos with her scissors near the running life-thread, and a Sun-god enthroned in the place of a law of gravitation. As was natural, man, who thus imposed his laws upon nature, soon lost all his former humility, and from one erroneous extreme passed to the opposite: as once he fell abjectly down in an agony of fear, so now he rose proudly up in an ecstasy of conceit.

The assertion that man is the measure of the universe was the definite expression of this metaphysical stage of human development. But it was a state that must plainly be fruitless of real knowledge; there could be no general agreement among men when each one looked into his own mind, and, arbitrarily framing the principles of external nature out of what he thought he found there, evolved the laws of the world out of the depths of his own consciousness. Disputes must continually arise about words when words have not definite meanings;

and the unavoidable issue must be Sophistry and Pyrrhonism. This has been so; the history of the human mind shows that systems of scepticism have alternated regularly with systems of philosophy. Fruitful of empty ideas and wild fancies, philosophy has not been unlike those barren women who would fain have the rumbling of wind to be the motion of offspring.

Convinced of the vanity of its ambitious attempts, Socrates endeavoured to bring philosophy down from the clouds, introduced it into the cities, and applied it to the conduct of human life; while Plato and Aristotle, opposite as were their professed methods, were both alive to the vagueness of the common disputations, and both laboured hard to fix definitely the meanings of words. But words cannot attain to definiteness save as living outgrowths of realities, as the exact expressions of the phenomena of life in the increasing speciality of human adaptation to external nature. As it is with life objectively, and as it is with cognition or subjective life, so is it with the organic growth of the language in which the phenomena are embodied: there is a progress from the simple to the complex. When the words of the Aryan languages are carefully analysed into their last radical elements, those prehistoric or primordial elements which resist further analysis, we trace a gradual progress from simple to mixed modes of thought, and from concrete to abstract conceptions; there is a continuous differentiation, first of nouns into substantives and adjectives, then of the latter into adjectives proper and nouns abstract; synonymes again disappear, each getting its special appropriation, for the more ancient a language the richer it is in synonymes, and superfluous words are taken up by new developments and combinations of thought.* How, then, was it possible that a one-sided method, which entirely ignored the examination of nature, should do more than repeat the same things over and over again in words which, though they might be different, were yet not less indefinite? The results have answered to the absurdity of the method; for, after being in fashion for more than two thousand years, nothing has been established by it; "not only what was asserted once is asserted still, but what was a question once is a question still, and instead of being resolved by discussion is only fixed and fed." (1) *

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* "There are dialects spoken at the present day which have no abstract nouns, and the more we go back in the history of languages,

Perhaps if men had always lived in the sunny climes of the south, where the luxuriance of nature allowed of human indolence and internal contemplation, they might have continued vainly to speculate; but when they were brought face to face with nature in the rugged north, and were driven to force by persevering labour the means of subsistence from a sterile soil, then there arose the necessity to observe her processes and investigate her secret ways. It has been remarked that the religions of the world have originated in subtropical climates where nature does not necessitate a continued and intense application to labour: Zoroaster, Moses, Buddha, Christ, Mahomet, having all belonged to subtropical zones. In cold and temperate climes, where man must observe and work, rather than meditate and pray, in order to live, there was an unavoidable intending of the mind to the realities of nature; and this practice, which the exigencies of living first enforced, became, in the fulness of time, with those who had leisure and opportunity, the disposition consciously to interrogate and interpret

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the smaller we find the number of these useful expressions. As far as language is concerned, an abstract word is nothing but an adjective raised into a substantive." Auxiliary verbs have the same position among verbs as abstract nouns among substantives; they are of late origin, and had originally a more material and expressive character.—MAX MÜLLER, *Chips from a German Workshop*, vol. ii. p. 54.

* See Notes at the end of the Chapters.

nature. In Roger Bacon, we see the human mind striving unconsciously, as it were, after the true method of development; while in Francis Bacon, who systematized the principles and laid down the rules of the inductive philosophy, we observe it doing with design and method that which it had hitherto been blindly aiming at. But as it is with the infant, so was it with humanity; action preceded consciousness, and Bacon himself was the efflux of a spirit which prevailed and not the creator of it; he was the conscious exponent of an unconscious impulse at work. By thus humbling himself to obey, man has conquered nature; and those plenteous "fruits and invented works" which Bacon confidently anticipated as "sponsors and sureties" for the truth of his method have been reaped in the richest abundance.

It seems strange enough now to us that men should not have sooner hit upon the excellent and profitable method of induction. How came it to pass that when they surveyed organic nature, as Aristotle notably did, they failed to perceive the progress in development from the general and simple to the special and complex, which is evident throughout it, and which in modern times has been formularized by Von Baer as the law of progress in organic development? Had they but formularized this law of increasing speciality and complexity in organic adaptation to external nature, then they had scarcely failed to apply it to conscious human development; and that would have been to establish deductively the necessity of the inductive method.* Unfortunately, Aristotle stood alone; and it remains his particular merit to have foreseen in some sort the value of the inductive method. Had he also consistently followed it in practice, which he did not, there was an impassable hindrance to its general adoption, in the moral errors engendered by the metaphysical or subjective method, of which Plato was so powerful a representative and so eloquent an exponent. Man, as the measure of the universe, esteemed himself far too highly to descend to be the servant and interpreter of nature; and this erroneous conceit not only affected his conception of his relation to the rest of nature, but permeated his social nature, and vitiated his whole habit of thought. The superstitious reverence of the Greek, who would put to death a victorious general because he had left his dead unburied on the field of battle, must, we cannot doubt, have prevented Aristotle from anatomical examination of the structure of the human body. The same errors are continually reappearing in human history under new forms: what happened in the Middle Ages may illustrate for us the habit of Greek thought; for at that time mistaken religious prejudice allied itself most closely with the metaphysical method which exalted man so much over the rest of nature, opposing most virulently the birth of positive science, which seemed to threaten to degrade him; and for a time it was doubtful which would win. Can we wonder that the erroneous method was triumphant in Greece in the fourth century before Christ, when it is only recently in England, in the nineteenth century after Christ, that the barbarian's reverence for a dead body has permitted anatomical dissection, and when the finger-bone of a saint, or a rag of his clothing, is still treasured up in some parts of the civilized world as a precious and sacred relic indued with miraculous virtues! The evil of the metaphysical method was not intellectual deficiency only, but a corresponding baneful moral error.

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* "Every one of our beliefs, as Kant saw very clearly, is at the same time subjective and objective; involving both an active and a passive condition of the mind. The real bearing of this great logical conception is an extension to the intellectual operations of the fundamental principle of biology, the correspondence of organism and environment common to every vital phenomenon."—COMTE'S *Positive Polity*, vol. i. p. 575. (*English Translation.*)

The adoption of the inductive method, which makes man the servant and interpreter of Nature, is in reality the systematic pursuance of the law of progress in organic development; it is the conscious intending of the mind to external realities, the submitting of the understanding to things—in other words, the increasing speciality of internal adjustment to external impressions; and the result is a victory by obedience, an individual increase through adaptation to outward relations, in accordance with the so-called principle of natural selection. For in mental development, as in organic development, that variation will survive which is best fitted to survive. The mental capacity of one who is deprived of any one of his senses, which are the inlets to impressions from without, or the gateways of knowledge, is less than that of one who is in the full possession of all his senses; and the great advances in science have uniformly corresponded with the invention of some instrument by which the power of the senses has been increased, or their range of action extended. Astronomy is that which the eye has been enabled to discover by the aid of the telescope; the revelations of new and marvellous worlds of nature have been due to the increased power of vision which the microscope has conferred; the extremely delicate balance has supplied to science a numerical exactness; the spectrum has furnished a means of analysing the constitution of the heavenly bodies; and the galvanometer has given hopeful presages of important discoveries in nervous function.

By the invention of these powerful aids to the senses, we have succeeded in penetrating into regions of nature which in times past were utterly unknown and undreamt of; but the deeper our inquiries have gone, the more clear has it been made that the phenomena with which the senses, whether aided or unaided, bring us into relation, are but an inconsiderable fraction, on the one hand, of the infinite magnitude of the universe, and, on the other hand, of the infinitely minute and complex molecular activities of nature, which are equally inaccessible to our present powers of perception—as in conceivable to us as colour to the blind, or as music to the deaf. Art has attained to the skill to measure the one-millionth of an inch, to detect a rise in temperature of 8,800th of a degree centigrade, to reveal by the spectroscope the 180,000,000th part of a grain of soda; but these are probably only coarse measurements when compared with the delicacy of the sense of smell, or at any rate with the infinite minuteness of the molecular activities of matter. There is endless room for further development of the senses. Through them has knowledge entered; and the intellect has in turn devised means for extending their action and increasing their discriminating exactness: there have been action and reaction and progressive specialization and complication thereof. The two aspects of this relation we designate, in their highest manifestations, as cognition and action, or science and art.

That which lies outside the relations of the subject, with which man cannot come into any sort of relation by his senses or otherwise, which lies therefore altogether beyond consciousness, has been called the Real, the Unconditioned, the Absolute, the Unknowable; and it would not be difficult to invent another meaningless term, beginning with a capital letter, in order to name the unnameable. Such existence has no more relation to us as conscious beings than the moral feelings of mankind have to the sensibility of an oyster or of an infusory animalcule; it could be known only by a consciousness which had the power of transcending consciousness; and to affirm anything of it, either positive or negative, is simply nonsense. Metaphysicians have, it is true, sometimes converted this impotence into a superconscious faculty of mind to which they have given a big name, such as Intuition of the Absolute or the like; but although we may think it probable, or feel certain, that there is existence beyond human consciousness, which is no more knowable by us than are moral relations by the oyster or the infusory animalcule, we are not entitled to make a positive cognitive faculty out of what is a negation. Whence do we derive the assurance we have of existence transcending human consciousness, if all we know, feel, and believe are states of consciousness? I cannot but look upon it as the utterance or blind prophecy of an instinct which will have conscious development hereafter; in other words, as the prompting of that impulse of evolution working in us which has been from the beginning, and still is, and through which it may well come to pass, ages hence, that much or something of what now lies beyond the range of human consciousness will come within the consciousness of new or more highly developed faculties of superior beings; nature thus going on in her evident progress to attain to more complete self-consciousness. Products of the mighty past, we forefeel dimly, as it were, the mighty future, of humanity.

Thus much concerning the historical evolution of the inductive method. But now comes the important question whether it is available for the study of the whole of nature. Can we apply the true inductive and objective method to the investigation of psychical as well as of physical nature? In the latter case it has long received universal sanction; but in the study of a man's mind it is still a question what method should rightly be employed. Plainly, it is not possible by simple observation of others to form true inductions concerning their mental phenomena; the defects of an observation which reaches only to the visible results of invisible operations expose us without protection to the hypocrisy, conscious or unconscious, of the individual; and the positive tendency, which no one can avoid, to interpret the action of another mind according to the measure of his own, to see not what is in the object but what is in the subject, frequently vitiates an assumed penetration into motives. If we call to our aid the principles of the received system of psychology, matters are not mended; for its ill-defined terms and vague traditions, injuriously affecting our perceptions and overruling the understanding, do not fail to confuse and falsify inferences. It must unfortunately be added that, in the present state of physiological science, it is quite impossible to ascertain, by observation and experiment, the nature of those organic processes which are the bodily conditions of mental phenomena. There would appear, then, to be no help for it but to have entire recourse to the psychological method — that method of interrogating self-consciousness which has found so much favour at all times.

Before making any such admission, let this reflection be weighed: that the instinctive *nisus* of mankind commonly precedes the recognition of systematic method; that men, without knowing why, do follow a course for which very good reasons exist. Nay, more: the practical instincts of mankind often work beneficially in actual contradiction to their professed doctrines. When in the Middle Ages faith was put in the philosophy of the schools, the interrogation of nature by experiment was going on in many places; and the superstitious people that believe in the direct interference of spirits or of gods, still adopt such means of self-protection as a simple experience of nature teaches. Man does not consciously determine his method and then enter upon it; he enters blindly upon it and at a certain stage awakes to consciousness. The process of reasoning itself adds nothing to knowledge; it only displays what was there before, brings to conscious possession what before was unconscious, makes explicit what was implicit in practical instinct. In the onward flowing stream of nature's organic evolution, life first becomes self-conscious in man: in the slumbering mental development of mankind, it is the genius who at due time awakens to active consciousness the sleeping century. It would indeed go hard with mankind if they must act wittingly before they acted at all.

Two facts come out very distinctly from a candid observation of the state of thought at the present day. One of these is the little favour in which metaphysics is held and the very general conviction that there is no profit in it: the consequence of which firmly fixed belief is, that it is cultivated as a science only by those whose particular business it is to do so, who are engaged not in action, wherein the true balance of life is maintained, but in speculating in professorial chairs, or in other positions where there are little occasion for hard observation and much leisure for introspective contemplation; or if by any others, by the ambitious youth who goes through an attack of metaphysics as a child goes through an attack of measles, getting haply an immunity from a similar affection for the rest of his life; or, lastly, by the active and ingenious intellects of those metaphysical philosophers who, never having been trained in the methods and work of a scientific study of nature, have not submitted their understandings to facts, but live in a more or less ideal world of thought. A second fact, which has scarcely been sufficiently weighed, is the extreme favour in which biography is held at the present time and the large development which it is receiving.

Let us look first at the import of biography. As the business of a man in the world is action of some kind, and as his actions undoubtedly result from the relations between him and his surroundings, it is plain that biography, which estimates both the individual and his circumstances and displays their inter-workings, can alone give an adequate account of the man. What was the mortal's force of character, what was the force of circumstances, how he struggled with them, and how he was affected by them,—what was the life-product under the particular conditions of its evolution; these are the questions which a good biography aspires to answer. It regards men as concrete beings, takes note, if it does its work properly, of their ancestral antecedents, acknowledges the differences between them in characters and capabilities, recognises the helpful or baneful influence of surroundings, and patiently unfolds the texture of life as the inevitable result of the elements out of which, and the conditions under which, it has been worked. It is, in fact, the application of positive science to human life and the necessary consequence of the progress of the inductive philosophy. No marvel, then, that biography forms so large a part of the literature of the day, and that novels, its more or less faithful mirrors, are in so great request. The practical instincts of mankind are here, as heretofore, in advance of systematic knowledge or method.

On the other hand, the metaphysician has dealt with man as an abstract or ideal being, having taken no account of concrete men, has postulated him as a certain constant quantity, and thereupon confidently enunciated empty propositions. The consequence is that metaphysics has never made any advance, but has only appeared in new garb; nor can it in truth advance unless some great addition is made to the inborn power of the human mind. It surely argues no little conceit in any one to believe that what Plato and Descartes have not done, he, following the same method, will do.* Plato interrogated his own mind, and set forth its answers with a clearness, subtilty, and elegance of style that is unsurpassed and unsurpassable; until then the probably yet far distant event of a better mind than his making its appearance, his system may well remain as the adequate representation of what the metaphysical method can accomplish. Superseded by a more fruitful method, it is practically obsolete; and its rare advocate, when such a one is found, may be said, like the Aturian parrot of which Humboldt tells, to speak in the language of an extinct tribe to a people which understand him not.†

But the method of interrogating self-consciousness may be employed, and is largely employed, without carrying it to a metaphysical extreme. Empirical psychology, founded on *direct* consciousness as distinguished from the *transcendental* consciousness, whatever that may be, on which metaphysics is based, claims to give a faithful record of our different states of mind and of their mutual relations, and has been extravagantly lauded by the Scotch school as an inductive science. It is argued, and with great cogency, that such states as thoughts, feelings, memories, volitions, are subjective, known only to the individual's consciousness, the words denoting them having acquired their meaning from introspection; that they admit of classification, which obviously can only be done by introspection; and that there may therefore be a science of mind, a psychology, which may stand on its own basis and be studied independently of all other sciences. The question then is concerning the nature of the basis. Its value as an independent science must plainly rest upon the trustworthiness and the sufficiency or competence of consciousness as a witness of that which takes place in the mind. Is the foundation sufficiently secure? It may well be doubted; and for the following reasons:—

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* "It would be an unsound fancy and self-contradictory, to expect that things which have never yet been done can be done, except by means which have never yet been tried."—*Nov. Org.* Aphorism vi. Forasmuch, however, as we have good grounds for believing that there is an accumulation of the inherited results of mental acquisitions through the ages, whereby an inborn addition is made to the power of the individual mind, we must admit the possibility that those who can detect the forms and laws of thought by introspection may, after all, be able to do more than has been done in times past.

† "There still lives, and it is a singular fact, an old parrot in Maypures which cannot be understood, because, as the natives assert, it speaks the language of the Atures—an extinct tribe of Indians, whose last refuge was the rocks of the foaming cataract of the Orinoco."—HUMBOLDT, *Views of Nature*, vol. i. p. 172.

(*a.*) The first, which is of no great weight, seeing that a similar objection might be made to observation in any other science, is, that there are but few individuals who are capable of attending to the succession of phenomena in their own minds; such introspection demanding a particular cultivation, and being practised with any degree of, or pretence to, success by those only who have learned the terms, and been imbued with the theories, of the system of psychology supposed to be thereby established. And with what success?

(*b.*) There is no agreement between those who have acquired the power of introspection; and men of apparently equal cultivation and capacity will, with the utmost sincerity and confidence, lay down inconsistent or directly contradictory propositions. It is not possible to convince either opponent of error, as it might be in a matter of objective science, because he appeals to a witness whose evidence can be taken by no one but himself, and whose veracity, therefore, cannot be tested. He brings forward the factitious deliverances of his individual consciousness, but no fact which is capable of being demonstrated to another mind. Now there is no witness who is so easily suborned to give false evidence, and whose testimony at all times requires such stringent cross-examination, as self-consciousness. For when it is at work, the observed and the observer are one, and the observer is not likely in such case to be unbiased by the feelings of the observed and to conform rigidly to the rules of exact observation. In external observation we find it necessary to lay down strict rules in order to avoid fallacies; it is certainly not less necessary to do so in observation from within.

(*c*.) To direct consciousness inwardly to the observation of a particular state of mind is to isolate that activity for the time, to cut it off from its relations, and, therefore, to render it unnatural. In order to observe its own action, it is necessary that the mind pause from activity; and yet it is the train of activity that is to be observed. So long as you cannot effect the pause necessary for self-contemplation, there cannot be a sufficient observation of the current of activity: if the pause is effected, then there can be nothing to observe; there would be no consciousness, for consciousness is awakened by the transition from one physical or mental state to another.* This cannot be accounted a vain and theoretical objection, for the results of introspection too surely confirm its validity: what was a question once is a question still, and instead of being resolved by introspective analysis is only "fixed and fed."(2)

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* To persist in one mode or state of consciousness would be really to be unconscious; wherefore when our attention is given intensely to some observation or reflection, so that we are absorbed in it, we hardly seem to be conscious; in fact, consciousness is aroused when the attention wanders. We do not perceive one continuous and unvarying action upon the senses, *e.g.* the movement of the earth, the pressure of the atmosphere upon the surface of our bodies, &c. For the same reason probably we do not hear the music of the spheres; a sound of unvarying tone and continuance falling on the ears from the first moment of life. And yet it is possible the noise may be stupendous.

(*d.*) The madman's delusion, which is only an extreme instance of error growing out of causes that are constantly at work to pervert an individual's feeling and to vitiate his reasoning, is of itself sufficient to excite profound distrust, not only in the objective truth, but in the subjective worth, of the testimony of an individual's self-consciousness. Descartes laid down the test of a true belief to be that which the mind could clearly and distinctly conceive: if there is one thing more clearly and distinctly conceived than another, it is commonly the madman's delusion. No marvel, then, that psychologists, since the time of Descartes, have held that the veracity of consciousness is to be relied upon only under certain rules, from the violation of which, Sir W. Hamilton believed, the contradictions of philosophy had arisen. On what evidence, then, do the rules rest? Either on the evidence of consciousness, whence it comes to pass that each philosopher and each lunatic has his own rules, and no advance is made; or upon the observation and judgment of mankind, to confess which is very much like throwing self-consciousness overboard —not otherwise than as was advantageously done by positive science when the exact figures on the thermometer, and not the subjective and deceptive feelings of heat or cold, were recognised to be the true test of the individual's temperature.

The charge against self-consciousness is not merely that it cannot always be relied upon in that of which it does give information, but that it does not give any account of a large and important part of our mental activity: its light reaches only to states of consciousness, not to states of mind. Its evidence, then, is not only untrustworthy save under conditions which it nowise helps us to fix, but it is of little value, because it has reference only to a small part of that for which its testimony is invoked. May we not then justly say that self-consciousness is utterly incompetent to supply the facts which shall lay the foundations of a truly inductive psychology? Let the following reasons further warrant the assertion :—

1. It is the fundamental maxim of inductive philosophy that observation should begin with simple instances, ascent being made from them step by step through appropriate generalizations, and that no particulars should be neglected. How does the interrogation of self-consciousness fulfil this just demand? It is a method which is applicable only to mind at a high degree of development, so that it perforce begins with those most complex instances which give the least certain information; while it passes completely by mind in its lower stages of development, ignoring those simpler instances which give the best or securest information. In this it resembles the philosopher who, while he gazed upon the stars, fell into the water; "for if," as Bacon says, "he had looked down, he might have seen the stars in the water, but, looking aloft, he could not see the water in the stars."(3) Where has the animal any place in the accepted system of psychology? or the child, the direction of whose early mental development is commonly decisive of its future destiny? To speak of induction, where so many important instances are neglected and others are selected according to caprice or the ease of convenience, is to rob the word of all definite meaning and mischievously to misuse it.

Psychology has neglected not only all animals except man, as it was bound by its method to do, but all the lower races of men : instead of being a science of mental phenomena as these are presented in nature, it represents the deliverances of the complex self-consciousness of an educated white man who has been specially trained in its method. Hence have arisen the hot disputes between the empiricists who looked on one side of the shield and the idealists who looked on the other side of it—between those who hold that all knowledge is derived from experience, and those who uphold the existence of forms of thought in the mind anterior to experience. Study the development of mind from its beginning in animals through its manifold gradations up to its highest reach in man, and it is made probable that the so-called forms of thought represent the innate mental capacities which are the result of evolution—which the civilized man has, and which the animal or the lowest savage has not. A psychology which is truly inductive must follow the order of nature, and begin where mind begins in the animal and infant, rising thence gradually to those higher and more complex mental phenomena which the introspective philosopher discerns or thinks he discerns. Certainly it may be said, and it has been said, that inferences as to the mental phenomena of the child can be correctly formed from the phenomena of the adult mind. But it is exactly because erroneous inferences have been made in that way, that the mental phenomena of the child have been misunderstood and misinterpreted, and that psychology has not received the benefit of the correction which a faithful observation of them would have furnished. It was the physiologist who by a careful observation of the lower animals, "having entered firmly on the true road, and submitting his understanding to things," arrived at generalizations which were found to explain many of the mental phenomena of the child, and which have furthermore thrown much light upon the mental life of the adult. The careful study of the genesis of mind is as necessary to a thorough knowledge of mental phenomena as the study of its plan of development confessedly is to an adequate conception of the bodily organization and its functions.

Again, it might be thought a monstrous mistake of nature to have brought forth so many idiots and lunatics, seeing that the introspective psychologists, though making a profession of induction with their lips, have taken no notice whatever of the large collection of instances afforded by such unwelcome anomalies. Certainly it may be said, and no doubt it has been said, that the mental phenomena of the idiot and lunatic are morbid, and do not, therefore, concern psychology. It is true that they do not concern a psychology which violently separates itself from nature. But it is exactly because psychology has thus unwarrantably severed itself from nature—of which the so-called morbid phenomena are no less natural a part than are the phenomena of health—that it has no sure foundations; that it is not inductive; that it has not received the benefit of the corrective instances which a faithful observation of the unsound mind would have afforded. In reality the phenomena of insanity, presenting a variation of conditions which cannot be produced artificially—the *instantia contradictoria*—furnish what in such matter ought to have been seized with the utmost eagerness; namely, actual experiments well suited to correct false generalization and to establish the principles of a truly inductive science. The laws of mental action are not miraculously changed nor reversed in madness, though the conditions of their operation are different; and nature does not recognise the artificial and ill-starred divisions which men, for the sake of convenience, and not unfrequently in the interests of ignorance, make.

2. Consciousness, which does not even tell us that we have a brain, is certainly incompetent to give any account of the essential material conditions which underlie every mental manifestation and determine the character of it. Let the function of an individual's optic ganglia be abolished by disease or otherwise, and he would not

be conscious that he was blind until experience had convinced him of it. Let him have a sensation of light or of sound, or any other seemingly most simple sensation, he would not learn through consciousness how complex it really is, nor even whether it proceeded from within or from without—whether it was entirely subjective or whether it had an objective cause; *that* he could only learn by subsequent discovery. The most simple phenomenon which consciousness makes known to us is really very complex; a feeling which is elementary to it may be far from elementary; and we cannot, by its means, go deeper into the discovery of the simpler constituent elements. Clearly then the science which does enable us to go deeper in the analysis of the really complex state which the most simple delivery of consciousness is, must lie at the foundation of a true psychology. On grounds which will not easily be shaken it is now indeed admitted, that with every display of mental activity there is a correlative change or waste of nervous element; and on the condition of the material substratum must depend the degree and character of the manifested energy or the mental phenomenon. Now the received system of psychology gives no attention to these manifold variations of feeling in the same individual which are due to temporary modifications of the bodily state, and by which the ideas of the relations of objects to self and to one another are so greatly affected. The quality of the ideas which arise in the mind under certain circumstances, the whole character indeed of our insight at the time, is notably determined in great part by the feeling which may then have sway; and that feeling is not always objectively caused, but may be entirely due to a particular bodily condition, as the daily experience of every one may convince him, and as the early phenomena of insanity often illustrate in a striking manner. The most ingenious introspectionist could never discover from the revelations of self-consciousness that the cause of a particular mood of mind lay in the liver, or in the heart, or in some other organ of the body; nor could he gain from them the least inkling how essentially the operations of these organs affect the characters of the individual, the actual constitution of his *ego*. Every sensation, again, is located by consciousness peripherally; it tells us plainly that touch is in the finger, sound in the ear, sight in the eye, smell in the nostrils; whereas physiological observation proves to us conclusively that this information is incorrect, and that each sensation has its immediate seat centrally in the brain.

Again, Bacon long ago set down *individual psychology* as wanting; and insisted on a scientific and accurate dissection of minds and characters, and the secret dispositions of *particular* men, so "that from the knowledge thereof better rules may be framed for the treatment of the mind." (4) So far as the present psychology is concerned, the *individual* might have no existence in nature; he is an inconvenience to a system which, in neglecting the individual character or temperament, ignores another large collection of valuable instances. So far as truth is concerned, however, the individual is of some moment, seeing that he often positively contradicts the principles arbitrarily laid down by a theoretical system. He who would realize how vague, uncertain, speculative, how far from the position of a true science, psychology is, should endeavour to grasp some one of its so-called principles, and to apply it deductively in order to predicate something of the character of a particular person; let him do that, and he cannot fail to perceive how much he has been mocked with the semblance of knowledge, and must needs agree with Bacon as to the necessity of a "scientific and accurate dissection of minds and characters and the secret dispositions of particular men." That, moreover, is a study which will be prosecuted successfully not by looking within but by looking without himself.

When the theologist, who occupies himself with the supersensuous, has said all that he has to say from his point of view; when the jurist, who represents those principles which the wisdom of society has established, has in turn exhaustively argued from his point of view,—then the ultimate appeal in a concrete case must be to him, be he physiologist or physician, who deals with the bodily organization; through his ground only can the theologist and jurist pass to their departments, and they must accept their knowledge of it from him: on the foundation of facts which the faithful investigation of the bodily nature lays, must rest, if they are to rest safely, their systems. Certainly it is not probable that this most desirable and inevitable result will come to pass in this day or generation; for it is not unknown how far distant yet is the day of full and exact physiological knowledge, nor how slowly, when it approaches, we may expect the light to penetrate the thick fogs of ignorance, and to dissipate the irritated prejudices which ever oppose the gentle advent of new truth. Happily, it is certain that in the mortality of man lies the salvation of truth.

3. There is an appropriation of external impressions by the mind or brain, which regularly takes place without any, or only with a very obscure, affection of consciousness. As the various organs of the body obtain from the blood the material suitable to their nourishment and assimilate it, so the organ of the mind unconsciously appropriates, through the inlets of the senses, the influences of its surroundings. The impressions which it thus receives and retains do not produce definite ideas and feelings, but they nevertheless permanently affect the mind's nature; so that as an individual consciously provides his food, and then leaves the due assimilation

of it to the unconscious action of the organism, in like manner may he consciously arrange the circumstances in which he will live, but cannot then prevent the unconscious assimilation of their influence and the corresponding modification of his character. Not only slight habits of movement are thus acquired, but habits of thought and feeling are imperceptibly organized; so that an acquired nature may ultimately govern one who is not at all conscious that he has changed. Let any one take careful note of his dreams, he will find that many of the seemingly unfamiliar things with which his mind is then occupied, and which appear to be new and strange productions, are traceable to the unconscious appropriations of the day. There are other stories on record like that well-known one which Coleridge quotes of the servant-girl who, in the ravings of fever, repeated long passages in the Hebrew language, which she did not understand, and could not repeat when well, but which, when living with a clergyman, she had heard him read aloud. The remarkable memories of certain idiots, who, much deficient in or nearly destitute of intelligence, will repeat the longest stories with the greatest accuracy, testify also to this unconscious cerebral action; and the way in which the excitement of a great sorrow, or some other cause, such as the last flicker of departing life, will sometimes call forth in idiots manifestations of mind of which they always seemed incapable, renders it certain that much is unconsciously taken up by them which cannot be uttered, but which leaves its relics in the mind.

It is a truth which cannot be too distinctly borne in mind, that consciousness is not co-extensive with mind, that it is not mind but an incidental accompaniment of mind. It may seem, perhaps it is, an extravagant thing to say, but to me it seems conceivable that a man might be as good a reasoning machine without as he is with consciousness, if we assumed his nervous system to be equally susceptible to the influences which now affect him consciously, and if we had the means, by microscope or galvanoscope or some other more delicate instrument hereafter to be invented, of reading off the results of his cerebral operations from without: we should be dispensing only with the sense by which the operations are observed within, not with the power by which they are done—with the witness not with the agent of them. From the first moment of its independent existence the brain begins to assimilate impressions from without, and to react thereto in corresponding organic adaptations; this it does at first without consciousness, and this it continues to do unconsciously more or less throughout life. Thus it is that mental power is being organized before the supervention of consciousness, and that the mind is subsequently regularly modified as a natural process without the intervention of consciousness. The preconscious action of mind, as certain metaphysical psychologists in Germany have called it, and the unconscious action of mind, which may perhaps be now deemed to be established, are assuredly facts of which the most ardent introspective psychologist must admit that self-consciousness can give us no account. I do not overlook the fact that some writers hold these supposed unconscious states not to be, as they appear, entirely unconscious, believing that it is because slight attention only is given to them that they pass away immediately and are forgotten. But if this be granted, it does not really alter matters much; for it would only prove that the brain or mind may do its work with a consciousness so slight as to be almost *nil*. A consciousness which has sunk to such a degree of subconsciousness as to be practically unconsciousness, cannot be of much moment in the operations: when so much is dispensed with, it is hardly worth while to contend for the importance of the little that is left.

4. That which has existed with any completeness in consciousness leaves behind it, after its disappearance therefrom, in the mind or brain, a functional disposition to its reproduction or reappearance in consciousness at some future time.(5) Of no mental act can we say that it is "writ in water;" something remains from it whereby its recurrence is facilitated. Every impression of sense upon the brain, every current of molecular activity from one to another part of the brain, every cerebral reaction which passes into muscular movement, leaves behind it some modification of the nerve elements concerned in its function some after-effect or, so to speak, memory of itself in them which renders its reproduction an easier matter, the more easy the more often it has been repeated, and makes it impossible to say that, however trivial, it shall not under some circumstances recur. Let the excitation take place in one of two nerve-cells lying side by side, and between which there was not any original specific difference, there will be ever afterwards a difference between them. This physiological process, whatever be its nature, is the physical basis of memory, and it is the foundation of the development of all our mental functions.

That modification which persists or is retained in structure after function, has been differently described as a residuum, or relic, or trace, or disposition, or vestige, or again as potential, latent, or dormant idea. Not only definite ideas, but all affections of the nervous system, feelings of pleasure and pain, desires, and even its outward reactions, thus leave behind them their structural effects, and lay the foundations of modes of thought, feeling, and action. Particular talents are sometimes formed quite, or almost quite, involuntarily; and complex actions, which were first consciously performed by dint of great application, become automatic by repetition; ideas, which were at first consciously associated, ultimately coalesce and call one another up without any consciousness, as we see in the quick perception or intuition of the man of large worldly experience; and feelings, once active, leave behind them their unconscious residua, thus affecting the general tone of the character, so that, apart from the original or inborn nature of the individual, contentment, melancholy, cowardice, bravery, and even moral feeling are generated as the results of particular life-experiences. Consciousness is not able to give any account of the manner in which these various residua are perpetuated, and how they exist latent in the mental organization; but a fever, a poison in the blood, or a dream, may at any moment recall ideas, feelings, and activities which seemed to have gone for ever. The lunatic sometimes reverts, in his ravings, to scenes and events of which, when in his sound senses, he has no memory; the fever-stricken patient may pour out passages in a language which he understands not, but which he has accidentally heard; a dream of being at school again brings back with painful vividness the school feelings; and before him who is drowning every event of his life seems to flash in one moment of strange and vivid consciousness.(6) Some persons who suffer from recurrent insanity remember only in their lucid intervals the facts of former lucid intervals, and in their paroxysms of derangement the ideas, feelings, and events of former paroxysms. Dreams not remembered in the waking state may yet affect future dreams, appearing in them as vague and confused recollections.*

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* "A Lutheran clergyman of Philadelphia informed Dr. Rush that Germans and Swedes, of whom he had a considerable number in his congregation, when near death, always prayed in their native language, though some of them, he was confident, had not spoken these languages for fifty or sixty years."—ABERCROMBIE, *On the Intellectual Powers*, p. 142, 8th ed. 1838.

It has been before said that mind and consciousness are not synonymous; it may now be added, that the existence of mind does not necessarily involve its constant activity. Descartes maintained that the mind is a spiritual activity which always thinks; and others, resting on that assumption, have held that we must always dream in sleep, because the mind, being spiritual, cannot cease to act; for non-activity would be non-existence. Such opinions illustrate how completely metaphysical conceptions may overrule the best understanding: non-activity of function is certainly non-existence of function, but it is not mental annihilation; so far from the mind being always active, it is the fact that at each moment the greater part of the mental organization is not only unconscious, but inactive. Mental power exists in statical equilibrium as well as in manifested energy; and the utmost tension of a particular mental activity may not avail to call forth from their secret repository the dormant energies of latent faculty, even when its function is most urgently needed: no man can call to mind at any moment the thousandth part of his knowledge. How utterly helpless is consciousness to give any account of the statical condition of mind! But as statical mind is in reality the statical condition of the nervous substrata which minister to its manifestations, it is plain that, if we ever are to know anything of mental organization, it is to the progress of physiology that we must look for information.

5. Consciousness reveals nothing of the actual process by which one idea calls another into activity, and has no control whatever over the manner of the reproduction; it is only when the idea is made active by virtue of some association, when the *effect* solicits or extorts attention, that we are conscious of it; and there is no power in the mind to call up ideas indifferently. If we would recollect something which at the moment

escapes us, confessedly the best way of succeeding is to permit the brain to work unconsciously; and while the consciousness is otherwise occupied, the forgotten name or circumstance will oftentimes flash into the memory. A glass of wine or some other stimulant shall sometimes do more to arouse ideas by its physical or chemical action upon the nerve-element than the strongest efforts of attention will do. In composition the writer's consciousness is engaged chiefly with his pen and with the sentences which he is forming, while the results of the brain's unconscious working, matured by an insensible gestation, emerge from unknown depths into consciousness, and are by its help embodied in appropriate words. As there are undulations of ether which are too rapid, and others which are too slow, to produce the sensation of light when they strike upon the eye, so it is easy to conceive that there may be molecular vibrations in the nerve element which are either too rapid or too slow to generate consciousness, but which, nevertheless, suffice to effect these latent associations.

Not only is the actual process of the association of our ideas independent of consciousness, but that assimilation or blending of similar ideas, or of the like in different ideas, by which general ideas are formed, is in no way under the control or cognizance of consciousness. When the like in two perceptions is appropriated, while that in which they differ is neglected, it would seem to be by an assimilative action of the nerve-cells or circuits of the brain which, particularly modified by the first impression, have an attraction or affinity for a like subsequent impression: the nerve-element so modified and so ministering takes to itself that which is suitable and which it can assimilate, or make of the same *kind* with itself, while it rejects, for appropriation by other nerve-circuits, that which is unlike and which will not blend. Or that which takes place may perhaps be represented more correctly in this way: when two objects resemble one another, having common qualities of which we can form a general idea, that which is like in them will necessarily excite in the same nerve-tract of the brain exactly the same number and kind of molecular vibrations; the second perception will be a reproduction of the first, in so far as it is a perception of the qualities which the second object has in common with the first. Now this reproduction of the same vibrations, which is the perception of the like in two ideas, will take place the more readily because of the functional disposition to the reproduction of them which the first perception has left behind it; wherefore, as all experience shows, there is a tendency of mind to perceive resemblances. That in which the second perception differs from the first will also excite its appropriate vibrations, but if they do not blend into unity with any previously experienced ones, they are not readily apprehended, and may be overlooked entirely by consciousness; they are so feeble or pass away so rapidly perhaps that the state of consciousness appropriate to them is not produced. It is the aim, therefore, of a good training in observation and reasoning to compel attention to differences in order that they may make a fit impression and be registered, and thus to prevent too hasty generalization.

Whatever the organic process in the brain, it takes place, like the organic action of other elements of the body, quite out of the reach of consciousness. We are not aware how our general and abstract ideas are formed; the due material is consciously supplied, and there is an unconscious elaboration of the result. Mental development thus represents a sort of nutrition and organization; or, as Milton aptly says of the opinions of good men that they are truth in the making, so we may truly say of the formation of our general and complex ideas that it is mind in the making. When the individual brain is a well-constituted one, and has been duly cultivated, the results of its latent activity, rising into consciousness suddenly, sometimes seem like intuitions; they are strange and startling, as the products of a dream ofttimes are, to the person who has actually produced them. Hence it was no extravagant fancy in Plato to look upon them as *reminiscences* of a previous higher existence. His brain was a brain of the highest order, and the results of its unconscious activity, as they flashed into consciousness, would show like revelations, and might well seem intuitions of a higher life quite beyond the reach of present will.

But the process of unconscious mental elaboration is sufficiently illustrated in daily experience. The instantaneous judgments of the distance, the position, the size, the figure of objects, which accompany our visual sensations, are not consciously made, nor are they put in logical form; in fact, all the labours of philosophers hitherto have not been sufficient to discover and explain the processes by which we acquire them—to set forth explicitly the premisses, the reasoning, and the conclusions which are implicit in them. In dreams a person may compose vigorously and fluently, or speak eloquently, who can do nothing of the sort when awake; in the first stages of acute mania there is sometimes exhibited a wit, a liveliness of imagination, a fluency of speech, of which the person is utterly incapable when he is in sound health; schoolboys know how much a night's rest improves their knowledge of a lesson which they have been learning before going to bed; great writers or great artists, as is well known, have been truly astonished at their own creations, when they have calmly examined them after the enthusiasm of invention was past, and have been unable to conceive how they contrived to produce them; and to the unconscious action of the brain is owing, most probably, that occasional sudden consciousness, which almost every one at some time or other has had, of having been before in exactly the same circumstances as those which are then present, or having said or done exactly the same thing, though such a previous exact experience was impossible; but the action of the brain in the assimilation of events here momentarily anticipates consciousness, which, when aroused, finds a familiarity in them. The same conviction is sometimes felt in dreams. The impression is momentary, vanishing in the instant of feeling it, and cannot be recalled by any voluntary effort, nor can it be adequately described in words. Inventions seem sometimes, even to the discoverers, to be matters of accident and good fortune, who, however, have not failed to deserve the accident of good fortune by long labour and training in inquiry; the most voracious plagiarist is commonly the most unconscious; the best thoughts of an author are always the unwilled thoughts which surprise himself; and the poet under the inspiration of creative activity is, so far as consciousness is concerned, being dictated to. If we reflect, we shall see that it must be so; the products of creative activity, in so far as they transcend the hitherto experienced, are unknown to the creator himself before they come forth, and cannot therefore be the result of a definite act of his will; for to an act of will a conception of the result is necessary. "The character," says Jean Paul, speaking of the poet's work, "must appear living before you, and you must hear it, not merely see it; it must, as takes place in dreams, dictate to you, not you to it; and so much so that in the quiet hour before you might perhaps be able to foretell the *what* but not the *how*. A poet who must reflect whether in a given case he shall make a character say yes or no—to the devil with him: he is only a stupid corpse."*

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* *Aesthetik.*

If an inherited excellence of brain has conferred upon the individual great inborn capacity, it is well; but if he has not such heritage, then no amount of conscious effort will completely compensate for the defect. As in the germ of the higher animal there is the potentiality of many kinds of tissue, while in the germ of the lower animal there is only the potentiality of a few kinds of tissue; so in the good brain of a happily endowed man there is the potentiality of great assimilation and of great and varied development, while in the man of low mental endowment there is only the potentiality of a scanty assimilation and of small development. But it is ridiculous to suppose that the man of genius is ever a fountain of self-generating energy; whosoever expends much in productive activity must take much in by appropriation; whence comes so much of the truth which there is in the observation that genius is a genius for industry. They do most by genius who would do most without it. To believe that any one, how great soever his natural genius, can pour forth with spontaneous ease the results of great productive activity without corresponding labour in appropriation, is no less absurd than it would be to believe that the acorn can grow into the mighty monarch of the forest without air and light and without the kindly influence of the soil.

It has been previously said that mental function does not necessarily imply consciousness, and, again, that mental organization does not necessarily involve mental function; it may now be affirmed that the most important part of mental action, the essential process on which thinking depends, is unconscious mental, or, if the word be liked better, cerebral activity. We repeat, then, the question: how can self-consciousness suffice to furnish the facts of a true mental science? Assuredly it can give no account of its own origin. It is not a constant state, but rather a process of becoming conscious; only when the organic conditions of nerve element reach a certain height of energy or have a certain duration do they produce consciousness; and it is plain that they, thus lying beneath consciousness, are inaccessible to self-observation.

6. The brain not only receives impressions unconsciously, registers impressions without the co-operation of consciousness, elaborates material unconsciously, calls latent residua again into activity without consciousness, but it responds also as an organ of organic life to the internal stimuli which it receives unconsciously from other organs of the body. As the central organ to which the various organic stimuli of a complex whole pass, and where they are duly co-ordinated, it must needs have most important and intimate sympathies with the other parts of the harmonious system; and a regular quiet activity, of which we only become occasionally conscious in its abnormal results, does prevail as the consequence and expression of these organic sympathies. On the whole, this activity is even of more consequence in determining the tone of our feeling, or of our disposition, and the character of our impulses, than that which follows impressions received from the external world; when disturbed in a painful way, it becomes the occasion of that feeling of gloom or discomfort which does not itself give rise to anything more than an indefinite anticipation of coming affliction, but which clouds ideas that arise, rendering them obscure, unfaithfully representative, and painful. The rapidity and success of conception, and the reaction of one conception upon another, are much affected by the state of this active but unconscious cerebral life: the poet is compelled to wait for the moment of inspiration; and the thinker, after great but fruitless pains, must often tarry until a more favourable disposition of mind. We are brought into direct relations with external nature, perceiving and modifying it, by

means of our intellectual and active functions; they are, as cerebral functions, in close connection with the mechanisms of sensation and motion, of which their anatomical substrata may be regarded as continuations. But mind is constituted by affective as well as by intellectual and active functions, in every mental act there being a consensus of these three classes of functions; and the affective functions of the brain, which are probably in close relations with the internal organs of the body, are the foundation of the emotions and impulses, and give force, purpose, and unity to our intellectual and active life.

In insanity the influence of this sympathetic organic activity is most marked; for it then happens that the morbid state of some internal organ becomes the basis of a painful but formless feeling of profound depression, which ultimately condenses into some definite delusion. In dreams its influence is no less manifest; for he who has gone to sleep with a disturbance of some internal organ may find the character of his dreams to be determined by the feeling of the oppression of self of which the organic trouble is the cause: he is thwarted, he is afflicted, he is at school again, he is under sentence of death, he is attending at his own funeral; in some way or other his personality is oppressed, and the dream-drama takes its character from the affective tone. Most plainly of all, however, does the familiar influence of the sexual organs upon the mind witness to this operation; and it was no wild flight of "that noted liar—fancy" in Schlegel, but a truly grounded creation of the imagination, that he represented a pregnant woman as being visited every night by a beautiful child, which gently raised her eyelids and looked silently at her, but which disappeared for ever after delivery.* Whatever then may be thought of the theory of Bichat, who located the passions in the organs of organic life, it must be admitted that he therein evinced a just recognition of the importance of that unconscious cerebral activity which is the expression of the organic sympathies of the brain. Mind is without doubt the direct function of brain, but is not less certainly a function of the whole organism indirectly; for in the brain every organic function is represented directly or indirectly.

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* "In Schlegels—viel zu wenig erkanntem—Florentin sieht eine Schwangere immer ein schönes Wunderkind, das mit ihr Nachts die

In dealing with unconscious mental activity, and with mind in a statical condition, it has been a necessity to speak of brain and cerebral action, where I would willingly, to avoid offence that might be taken thereat, have spoken, had it been possible, of mind and mental action; but it was impossible, if one was to be truthful and intelligible, to do otherwise. When the important influence of the brain, as an organ of organic life, on mental life comes to be considered, there are no words available for expressing the phenomena in the language of the received psychology, which, though it admits the brain to be the organ of mind, takes no notice whatever of it as an organ. It may perhaps be maintained that it is improper and indeed absurd to speak of mind except when speaking of states of consciousness. This of course I do not admit, holding that there is a vast amount of mental function which goes on unconsciously. But if it be asserted that I am not justified in speaking of statical or inactive mind, mind being actual energy or function, I have nothing to reply; the reader must understand thereby the mental organization or that organization of brain which ministers to mental function, and pardon the incorrect expression, because of the difficulties with which the metaphysical conception of mind, infecting

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Augen aufschlägt, ihr stumm entgegen läuft u. s. w. und welches unter der Entbindung auf immer verschwindet."—JEAN PAUL, *Aesthetik.*

the common language of psychology, oppresses a writer. Psychologists, like Descartes, define mind to be the thinking or conscious substance, that is, the substance the functions of which are thought, feeling, and will. Those who do not admit any such spiritual substance, but hold that mind is a general term embracing these functions, the substance beneath which is brain, must sometimes use the words brain and mind loosely as meaning the same thing—namely, the substance, unless they are prepared to repudiate the language of pyschology, to go their own way using their own terms, and to abandon all attempts to reconcile the truth which there is in the old doctrines of pyschology with the new truth which is made known by the discoveries of modern physiology.* Mind, used in the sense of substance or essence, and brain, used in the sense of organ of mental function, are at bottom two names for the same substance; the former word being the symbol by which it is denoted through the inner sense of consciousness, the latter word the symbol by which the outer senses denote it; in like manner, such psychological terms as idea and will are to the inner sense symbols of cerebral functions which are known to the outer senses as physiological nervous currents or excito-motor processes in the cerebral convolutions. He who should insist on keeping these different symbols of the same substance or process punctiliously distinct on every occasion, and should scrupulously shrink from ever translating one into terms of the other, makes an abrupt and arbitrary division in knowledge where there is continuity in nature, building up two distinct sciences out of a study of the same subject-matter, and acts very much as a person would do who should refuse to recognize an object, when it is perceived by or described in terms of one sense, to be the same object as it is when perceived by or described in terms of another sense; who should insist, for example, on giving a different name to the orange which he perceives by touch from that which he gives to the orange

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* The doctrine of latent modifications of mind—of unconscious acts and affections of mind—which Sir W. Hamilton declared to be "established beyond all rational doubt," has no difficulties to face before it is accepted, if we distinctly apprehend the fact that the organ is brain and the function mind, and view the doctrine by the light of our knowledge of other nervous functions. But it would be quite impossible to get forward if one made this explanation on every occasion on which it was necessary to take account of psychological doctrines implying a mental essence. When the psychologist declares that perception is not in the brain, but in the "unknown essence mind," he affirms both what is true and what is untrue. It is true that perception is not strictly in the brain, because perception is function, and function cannot justly be said to be in the organ; unquestionably function is *potential* in organ, but when it has become actual in consequence of material changes in the organ, it is energy which has gone forth from the organ, and cannot any longer be said properly to be in it. Perception being part of the function—mind, may therefore be said to be in mind. We know nothing of the organ and its changes by self-consciousness; the knowledge which we get through consciousness is necessarily of function; wherefore it is so far true that we only know mental states in consciousness. But it is untrue, or at any rate it is a gratuitous assumption, for which there is no warrant in facts, to affirm that consciousness is the function of an unknown essence—

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mind, and that it cannot be a function of brain. Consciousness cannot possibly tell us what is and what is not function of brain, and when it undertakes to do so, goes entirely beyond its province, and acts as absurdly as a man in a dark room in which he had never been before would do, if he were to undertake to declare positively from his own observation what was and what was not in the room. It is not true, as might be said, that physiology makes a like gross mistake when it undertakes to declare that which is known only in consciousness, to be a function of brain, for although it cannot witness to what passes in consciousness only, an individual can by its method of observation and experiment produce and observe variations in his consciousness corresponding with artificially produced variations of brain-states, and can justly infer similar correlative effects from similar observations made by him upon other persons.

which he perceives by sight, and on always keeping the perceptions of his different senses punctiliously distinct.

Let me briefly go on now to state what the relations of the brain as a bodily organ are.

1. The brain has, as previously set forth, a life of relation; which may be properly distinguished into—(*a*) a relation with external nature through the inlets of the senses; and (*b*) a relation with the other organs of the body through the nervous system distributed throughout the body. These have already been sufficiently dwelt upon here; they will receive fuller attention afterwards.

2. But the brain has also a life of nutrition, or, if I may so call it, a vegetative life. In this its true organic life, there is a nutritive assimilation of suitable material from the blood by the nerve cell; a restoration of the statical equilibrium being thereby effected after each display of energy. The extent of the nutritive repair and the mould which it takes must plainly be determined by the extent and form of the change or waste of matter which has been the condition of the display of function: the material change or waste in the nerve cell or circuit, which the activity of an idea implies, is replaced from the blood according to the mould or pattern of the particular idea; statical functional potentiality thus following through the agency of nutritive attraction upon the waste of active idea through functional repulsion. The elements of the nerve cell or circuit grow to the form in which it energizes. Whatever be the intimate molecular process, it is certain that the functional disposition which previous function produces is effected by nutrition, that it requires a rich supply of blood, such as the brain is known to have, and that it cannot be effected if the supply of blood is cut off. This organic process of repair is not usually attended by consciousness, and yet it may obtrude itself into consciousness: as the function of any organ, which proceeds,

when all is well, without exciting any sensation, does, under conditions of disorder, give rise to unusual sensation or to actual pain; so the organic life of the brain, which usually passes peaceably without exciting consciousness, may under certain conditions thrust itself forward into consciousness and produce anomalous effects. When this happens, the abnormal effect is not manifest in sensation, for the hemispheres of the brain, as physiologists well know, are not sensitive in that sense; but it is displayed in the involuntary appearance of emotional ideas in consciousness, and in consequent confusion of thought; the statical potentiality becomes energy, not through the usual train of association, but by reason of the abnormal stimulus from the inner life. Thus it is that the presence of alcohol or of some other such foreign agent in the blood will excite into activity ideas which lie out of the usual path of association, which the utmost tension of consciousness would fail to arouse, and which the will cannot repress nor control. Thus it is that in some forms of insanity the irruption of a vivid idea into consciousness, which may reach such an intensity of energy as to become an uncontrollable impulse, is attended with or preceded by an active determination of blood to the brain, the head becoming suddenly hot and the feet as suddenly cold. Whosoever will be at the pains of attending to his own daily experience will find that ideas frequently arise into consciousness without any apparent relation to those previously active; without, in fact, any possibility of explaining, *quoad* consciousness, why and whence they come. (7)

To what has been before said of unconscious mental function this more may now be added—that the deep basis of all mental function lies in the organic life of the brain, the characteristic of which in health is that it proceeds without consciousness. He whose brain makes him conscious that he has a brain is not well, but ill; and thought that is conscious of itself is not natural and healthy thought. How little competent, then, is consciousness to supply the facts of an inductive science of mind! Pneumatology was at one time subdivided into theology, demonology, and psychology; all three resting on the evidence of the inner witness. Demonology has taken its place in the history of human error and superstition; theology is confessedly now best supported by those who strive to ascend inductively from nature's law up to nature's God; and psychology, shorn of its former transcendental glories, stays its fall by appropriating the discoveries of physiology and by translating them into its still semi-metaphysical phraseology, preserving only in its nomenclature the shadow of its ancient authority and state. On what foundation can a science of mind rest safely, save on the faithful observation of all available instances, whether psychical or physiological?

Why, however, it will naturally be asked, repudiate and disparage introspective psychology, now that it evinces a disposition to abandon its exclusive mode of procedure and to profit by the discoveries of physiology? Because the union, as desired by it, is an unnatural and unhallowed union, which can only issue in abortions or give birth to monsters; not otherwise than as Ixion, designing impiously to embrace Juno, had intercourse with the clouds and begat centaurs. It is not a cursory perusal of physiological text-books, and a superficial acquaintance with the nature and functions of the nervous system, which will put meaning into the vague and abstract language of psychology; that would simply be to subject physiology to the tortures of Mezentius—to stifle the living in the embraces of the dead; but it is a sound general knowledge of the whole domain of organization, at the head of which stands the nervous system, and the final achievement or perfect consummation of which is mind, that is indispensably pre-requisite to the formation of fundamentally true conceptions of mental phenomena on a physiological basis. The processes most nearly resembling mental processes are those of life, for mind is the function of the highest and most complex vital structure; it is the most complex and special form of life which we have to do with; wherefore the study of vital processes may be justly declared to be the necessary foundation of the scientific study of mental phenomena. The question between modern physiology and the old pyschology is not a question of eclectic appropriation of the discoveries of the former by the latter, but a fundamental question of method of study.

But when our conceptions have been vitally informed by physiological knowledge, it will be found a hard matter to express them adequately and exactly in the terms of pyschology. One conviction cannot fail to be brought home to those who have pursued the physiological study of mind—that it would have been well if the inquirer, after rising step by step from the investigation of life in its lowest forms to that of its highest and most complex manifestations, could have entered upon the study of mental phenomena without being hampered by any philosophical theories concerning their nature, and could have described them in terms which were free from any previous metaphysical meanings. For the terms of psychology have these faults—first, they are vague and obscure; and, secondly, they often imply false theories. Used at first to denote external things, before there was a conception of the nature of such external things as vital processes are, they were borrowed and used in a sort of figurative sense to express internal states, and have now become so abstract, and been so depraved by their divorce from nature, as to be almost empty of real meaning. Secondly, there is hardly a single term which does not imply a theory, and a theory which is mostly either inadequate or false: understanding, will, idea, mind, are all terms which involve psychological theories, and cannot easily be divested of them. Indeed it is not possible to write a sentence concerning our highest mental functions in terms of psychology without implying, if the word have any meaning at all, entities which are merely objectified abstractions. Moreover, this also must be borne in mind, for it aggravates our difficulties—that a word is not merely a definite symbol of something, but a centre also of various associations which affect essentially its meaning; use it then as carefully as we may in its psychological sense, we cannot detach these associations from its meaning, and in spite of ourselves are driven to raise a metaphysical haze.*

Such are the charges against self-consciousness whereon is founded the conclusion as to its incompetence; they show that he who thinks to illuminate the whole range and depth of mental function by the light of his own consciousness is not unlike one who should go about to illuminate the universe with a rushlight. A reflection on the true nature of consciousness will surely tend to confirm that opinion. Whoever endeavours faithfully and firmly to obtain a definite idea of what is meant by consciousness, will find it nowise so easy a matter as the frequent and ready use of the word might imply. Metaphysicians, faithful to the vagueness of their ideas, and definite only in individual assumption, are by no means agreed in the meaning which they attach to it; and it sometimes happens that the same metaphysician uses the word in two or three different senses in different parts of his book: Sir W. Hamilton, for example, uses it at one time as synonymous with mind, at another time as synonymous with knowledge, and at another time to express a condition of mental activity. That there should be so little certainty about that upon which their philosophy fundamentally rests must be allowed to be no small misfortune to the metaphysicians.

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* Another consequence is that those who, being familiar with psychological analysis and ignorant of physiology, go to work to criticise the physiological exposition of mental phenomena, often fail entirely to realise the meaning of that which they criticise; the words do not convey any physiological associations to their minds, while at the same time they arouse the familiar psychological associations; the result being that such critics go round and round in a circle grinding psychological wind without really touching the essential facts. They might do worse than take the advice which a mystic like Schopenhauer gives them:—"I pray you do not write on physiology in its relations to psychology, without having digested Cabanis and Bichat *in succum et sanguinem*; in return you may leave many German scribblers unread. At best the study of psychology is vain, for there is no Psyche; men cannot be studied alone, but in connection with the world—microkosmus and makrokosmus combined—as I have done. And test yourself whether you really possess and comprehend physiology, which presupposes a knowledge of anatomy and chemistry."—ARTHUR SCHOPENHAUER, *His Life and his Philosophy*, by Helen Zimmern, p. 24.

What consciousness is will appear better if its relations be closely examined without prejudice. It will then be seen that it is not separable from knowledge; that it exists only as a part of the concrete mental act; that it has no more power of withdrawing from the particular phenomenon, and of taking full and fair observation of it, than a boy has of jumping over his own shadow. Consciousness is not a faculty or substance, but a quality or attribute of the concrete mental act. There is no consciousness without something of which one is conscious, no abstract consciousness without contents; and it may exist in different degrees of intensity, or it may be absent altogether. In so far as there is consciousness, there is certainly mental activity; but it is not true that in so far as there is mental activity there is consciousness; it is only with a certain intensity of representation or conception that consciousness appears. What else, then, is the so-called interrogation of consciousness but a self-revelation of the particular mental state whose character it must needs share? When the mental state is past, it is known, not by direct consciousness, but by memory; and the introspective observation of mental sequences by memory is assuredly subject to as many errors as the external observation of physical sequences by the senses. Consciousness can never be a valid and unprejudiced witness; for although it testifies to the existence of a particular mental modification, yet when that modification has anything of a morbid character, consciousness, which is a part of it, is necessarily affected by the taint and is morbid also. Accordingly, the lunatic appeals to the evidence of his own consciousness for the truth of his hallucination or delusion, and insists that he has as sure evidence of its reality as he has of the argument of any one who may try to convince him of his error. And is he not right from a subjective standpoint? To one who has vertigo the world turns round. A man may easily be conscious of free will when, isolating the particular mental act, he cuts himself off from the consideration of the causes which have preceded it and on which it depends. "There is no force," says Leibnitz, "in the reason alleged by Descartes to prove the independence of our free actions by a pretended lively internal sentiment. It is as if the needle should take pleasure in turning to the north; for it would suppose that it turned independently of any other cause, not perceiving the insensible motions of the magnetic matter."* Is it not supremely ridiculous that, while we cannot trust consciousness in so simple a matter as whether we are hot or cold, we should be content to rely entirely on its evidence in the complex phenomena of our highest mental activity? The truth is that what has very often happened before has happened here: the quality or attribute has been abstracted from the concrete, and the abstraction converted into an entity: the attribute, consciousness, has miraculously got rid of its substance, and then with a wonderful assurance assumed the office of commenting and passing judgment, from a higher region of being, upon the nature of that whereof it is actually a function. Descartes was in this case the clever architect, and his success has fully justified his art: while the metaphysical stage of human development lasts, his work will doubtless stand.

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* *Essais de Théodicée*, Pt. I. Spinoza uses a similar illustration of the moving stone.

That the subjective method—the method of interrogating self-consciousness—is not *adequate* to the construction of a true mental science, has now seemingly been sufficiently established. This is not to say that it is worthless; for when not strained beyond its capabilities, its results must, in the hands of competent men, be as useful as they are indispensable. We can investigate the properties of water without knowing its composition; in like manner, we can observe the associations and sequences of mental states without knowing their physical antecedents. Moreover, when we have discovered by objective inquiry the physical antecedents, we must still depend upon the help of subjective observation in order to establish the exact sequences of the mental states, which we only know by introspection, to the physical states which we observe and make experiments upon. D'Alembert compares Locke to Newton, and makes it a special praise to him that he was content to descend within, and that, after having contemplated himself for a long while, he presented in his "Essay" the mirror in which he had seen himself; "in a word, he reduced psychology to that which it should be—the experimental physics of the mind." But it was not altogether because of this method, but in some degree in spite of it, that Locke was greatly successful; it was because he possessed a powerful and well-balanced mind, the direct utterances of which he sincerely expressed, that the results which he obtained, in whatever nomenclature they may be clothed, are and always will be valuable; they are the self-revelations of an excellently constituted and well-trained mind. The insufficiency of the method used is proved by the fact that others adopting it, but wanting his sound sense, directly contradicted him at the time, and do so still. Furthermore, Locke did not confine himself to the interrogation of his own consciousness; for he introduced the practice—for which Cousin was so angry with him—of referring to savages and children. And one may take leave to suggest that the most valuable part of Locke's psychology, that which has been a lasting addition to knowledge, really was the result of the employment of the inductive or rather objective method; for psychology cannot be truly inductive unless it is studied objectively. Nay, more: if any one will be at the pains to examine candidly the history of the development of psychology up to its present stage, he may be surprised to find how much the important acquisitions of new truths and the corrections of old errors have been due, not to the interrogation of self-consciousness, but to external observation, though it was not recognised as a systematic method. Not the least valuable, though a hitherto little valued, part of the psychology of Descartes is that in which he treats of the automatic functions of the lower animals, anticipating in some important particulars the modern doctrine of reflex action. The past history of psychology—its instinctive progress, so to speak—no less than the consideration of its present state, proves the necessity of admitting the objective method.

That which a just reflection teaches incontestably, the present state of physiology illustrates practically. Though very imperfect as a science, physiology has made sufficient progress to prove that no psychology can endure except it be based upon its investigations. Let it not, moreover, be forgotten, as it is so apt to be, that there is a continuity throughout nature, and that the divisions in our knowledge are artificial; that they should be accepted and used rather, as Bacon says, "for lines to mark or distinguish, than sections to divide and separate; in order that solution of continuity in sciences may always be avoided."* Not the smallest atom which floats in the sunbeam, nor the minutest molecule which vibrates within the microcosm of an organic cell, but is bound as a part of the mysterious whole in an inextricable harmony with the laws by which planets move in their appointed orbits and with the laws which govern the marvellous creations of genius. Above all things it is now necessary that the absolute and unholy barrier set up between psychical and physical nature be broken down, and that a just conception of mind be formed, founded on a faithful recognition of all those phenomena of nature which lead by imperceptible gradations up to this its highest evolution. Happily the beneficial change is being gradually effected, and ignorant prejudice or offended self-love in vain opposes a progress in knowledge which reflects the course of progress in nature: the stars in their courses fight for such truth, and its angry adversary might as well hope to blow out with his pernicious breath the all-inspiring light of the sun as to extinguish its ever-waxing splendour.

No one pretends that physiology can, for many years to come, furnish the complete data of a positive mental science: all that it can at present do—and that is not a small service—is to overthrow the data of a false psychology. It is easy, no doubt, to point to the extent of our ignorance, and to maintain that physiology never will lay securely the foundations of a mental science, just as it was easy to say, before the invention of the telescope, that the ways of the planets could never be traced and calculated. The confident dogmatist in this matter might well learn caution from an instructive example of the rash error of a greater philosopher than he can claim or hope to be:—"It is the absurdity of these opinions," said Bacon, "that has driven men to the diurnal motion of the earth; *which, I am convinced, is most false.*"* What should fairly and honestly be weighed is, that mental organization is the last, the highest, the consummate evolution of nature, and that, therefore, it must be the last, the most complex, and most difficult object of human study. There are really no grounds for expecting a positive science of mind at present; for to its establishment the completion of the other sciences is necessary; and, as is well known, it is only lately that the metaphysical spirit has been got rid of in astronomy, physics, and chemistry, and that these sciences, after more than two thousand years of idle and shifting fancies, have attained to certain principles. Still more recently has physiology emerged from the fog, and this for obvious reasons: in the first place it is absolutely dependent upon the physical and chemical sciences, and must, therefore, wait for the progress of them; and, in the second place, its close relations to psychology, when it is concerned with the functions of the brain, have kept it under the spell of the metaphysical spirit. That, therefore, which should be in this matter is that which is, and instead of being a cause of despair, is a ground of hope.

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* *De Augmentis Scientiarum*, B. IV.

But let it not be forgotten that the physiological method deals only with one (I.) division of the matter to which the objective method is to be applied; there are other divisions not less valuable:—

II. The study of the *plan of development* of mind, as exhibited in the animal, the barbarian, and the infant, furnishes results of the greatest value, and is as essential to the construction of a true mental science as the study of its development confessedly is to a full knowledge of the bodily organism. By that means we get at the deep and true relations of phenomena, and are enabled to correct the erroneous inferences of a superficial observation; by examination of the barbarian, for example, we observe phenomena in the simple which, even when most simple, are still complex enough; we eliminate also the hypocrisy which is the result of the social condition, and which is apt to mislead us in the civilized individual. For information concerning the most distant epochs of human development—those which are prehistorical—our resources are not great; we make shift with an examination of the flint and bronze instruments and other records of art which have been discovered by modern research, and with a study of the formation and development of languages. In the language are embodied the thoughts and feelings of a period, and from it we are able to form reasonable conjectures concerning the social state and the beliefs thereof. For this purpose the study of myths also has been found most useful: they reveal mental states in which the anthropomorphic interpretation of nature was habitual, and carried to the extremest pitch,—a mode of interpretation of which we have still a survival in the masculine and feminine nouns of objects, such as sun and moon, in some modern languages. In his language, as also in his nature, man is the heir of the mental and moral labours of his most distant ancestors: it embodies, as his nature does, the accumulated acquisitions of successive generations of men.

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* *De Augmentis Scientiarum*, B. III.

III. The study of the *degeneration* of mind, as exhibited in the different forms of idiocy and insanity, is indispensable as it is invaluable. So we avail ourselves of the experiments provided by nature, and bring our generalizations to a most searching test. Hitherto the phenomena of insanity have been entirely ignored by psychologists and grievously misinterpreted by the vulgar, because interpreted by the false conclusions of a subjective psychology. Had not such material facts as the revelations of consciousness in dreams and in delirium been constantly neglected by those who professed to be inductive pyschologists, truer generalizations must perforce have been formed ere this, and fewer irresponsible lunatics would have been executed as responsible criminals. Why those who put so much faith in the subjective method do reject such a large and important collection of instances as dreams and madmen furnish, they have never thought proper to explain. Another promising but strangely neglected field of inquiry is a study of *criminals*. The time will come, ought to have come now, when prisons shall be used for the systematic investigation of the antecedents, and for the clinical study of the varieties, of the criminal nature, just as asylums are used for the clinical study of diseased minds, hospitals for the study of diseased bodies. It may be doubted whether half the books that have been written on moral philosophy would be worth one good book by an earnest and industrious inquirer who should undertake the scientific study of the inmates of a single prison.

IV. The study of *biography* and of autobiography, which has already been described as the application of positive science to human life, will plainly afford essential aid in the formation of a positive science of mind. Thus we trace the development of the mind in the individual as affected by hereditary influences, education, and the circumstances of life. Concerning autobiographies, however, it will not be amiss to bear in mind an observation made by Feuchtersleben, that "they are only of value to the competent judge, because we must see in them not so much what they relate as what, by their manner of relation, is undesignedly betrayed."

V. The study of the progress or regress of the human mind, as exhibited in *history*, most difficult as the task is, cannot be neglected by one who wishes to be thoroughly equipped for the arduous work of constructing a positive mental science. The unhappy tendencies which lead to individual error and degeneration are those which on a national scale conduct peoples to destruction; and the *nisus* of an epoch is summed up in the biography of its great man.* Freed from the many disturbing conditions which interfere so much with his observation of the individual, the philosopher may perhaps discover in history the laws of human progress in their generality and simplicity, as Newton discovered, in the motions of the heavenly bodies, the law for which he would have looked in vain had he watched the fall of every apple in Europe. Moreover, in the language, literature, painting, sculpture, and in the political, social and religious institutions of mankind, there are important materials for the construction of a science of mind. As Comte has set forth with great elaboration, the individual is a social unit, and cannot be comprehended independently of the social medium in which he lives; just as it is necessary to study his bodily organism in its relations with surrounding physical nature, so it is necessary to study his mental functions in their relations with the human nature of which he is a unit. No one who has given the least thought to the process of human evolution can be surprised that the prophet of a new religion, or a social reformer, or a philosopher does not appear among a tribe of Red Indians; when a man of superior mental endowments does appear among them he becomes a great hunter, or a great warrior, or a great orator in council; for he applies all his energies to the work in which it is the tribal ambition to excel, and the tribal joy to succeed. The history of mankind is a continuation of the natural history of the universe, and must have discoverable laws; but while the course of cosmic evolution as far as mind is completed, and known in part, its continued evolution in mind is far from complete, and is yet hardly known at all. However, as the astronomer can, from observation of a portion of a planet's course, draw the path of its entire orbit, so may it be possible in the time to come, from observation of the course of the past years of human development, to discover the laws of future development.

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* "When nature has work to be done," says Emerson, "she creates a genius to do it. Follow the great man, and you shall see what the world has at heart in these ages. There is no omen like that."

May we not then truly say that he only is the true psychologist who, occupied with the observation of the whole of human nature, avails himself not alone of every means which science affords for the investigation of the bodily conditions which assuredly underlie every display of function, conscious or unconscious, but also of every help, subjective or objective, which is furnished by the mental manifestations of animal and of man, whether undeveloped, degenerate, or cultivated? Here, as everywhere else in nature, the student must deliberately apply himself to a close communion with the external, must intend his mind to the realities which surround him, and thus, by patient internal adjustment to outward relations, gradually evolve into conscious development those inner truths which are the unavoidable expressions of the harmony between himself and nature. By diligent colligation of facts, patient observation of their relations, and careful consilience of inductions, he will attain to sound generalizations in this as in other departments of nature; in no other way can he do so. Of old it was the fashion to try to explain nature from a very incomplete knowledge of man; but it is the certain tendency of advancing science to explain man on the basis of a perfecting knowledge of nature.

Having fairly admitted a method, it behoves us to take heed that we are not too exclusive in its application. To this onesidedness there is a strong inclination: even in the investigation of physical nature men often now write of induction as Bacon himself never wrote of it. They would repudiate as impious all use of theory in scientific inquiries, forgetful that not a single question can be put to nature without some theory, and that in the interrogation of nature no answer is ever volunteered; the definite answer is not vouchsafed unless the definite question be put, or the definite experiment made, as Bacon says, *ad intentionem ejus quod queritur*. It might seem, from the usual fashion of speech, that the function of the mind was merely that of a polished and passive mirror, in which natural phenomena should be allowed simply to reflect themselves; whereas every state of consciousness is a developmental result of the relation between mind and the impression, of the subject and object. What Bacon strove so earnestly to abolish was the method of systematically looking into the mind and, by torture of self-consciousness, drawing thence empty ideas, as the spider forms a web out of its own substance,—that ill-starred divorce between mind and nature which had been cultivated by the Schoolmen as a method. What he wished, on the other hand, to establish was a happy marriage between mind and matter, between subject and object; to prevent the "mind being withdrawn from things farther than was necessary to bring into a harmonious conjunction the ideas and the impressions made upon the senses."* For, as he says, the testimony and information of the senses have reference always to man, not to the universe—to man's limited capacities of appre-

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* "Nos vero intellectum longius à rebus non abstrahimus quam ut rerum imagines et radii (ut in sensu fit) coire possint." (*Proleg. Instaurat. Magn.*) This passage, as usually rendered, is not intel-

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ligible; the translation in the text, if not literally exact, evidently, as the context proves, expresses Bacon's true meaning. He had objected to all before him that some had wrongly regarded the sense as the measure of things, while others, equally wrongly, "after having only a little while turned their eyes upon things, and instances, and experience, then straightway, as if invention were nothing more than a certain process of excogitation, have fallen, as it were, to invoke their own spirits to utter oracles to them. But we," he goes on, "modestly and perseveringly keeping ourselves conversant among things, never withdraw our understanding," &c. Mr. Spedding, in his admirable edition of Bacon's works, translates the passage thus:—"I, on the contrary, withdraw my intellect from them no further than may suffice to let the images and rays of natural objects meet in a point, as they do in the sense of vision." According to this interpretation—if there really is any meaning in it—the images and rays of objects express the same thing. Mr. Wood's translation, in Mr. Montagu's edition, is:—"We abstract our understanding no further from them than is necessary to prevent the confusion of the images of things with their radiation, a confusion similar to that we experience by our senses." This is worse still; *ut possint coire* means, certainly, "that they come together," not "that they may not mingle or may be prevented from mingling." After all, the 95th Aphorism furnishes the clearest and surest commentary on the passage—"Those who have treated the sciences were either empirics or rationalists. The empirics, like ants, only lay up stores and use them; the rationalists, like spiders, spin webs out of themselves; but the bee takes a middle course, gathering her matter from the flowers of the field and garden, and digesting and preparing it by her native powers. In like manner, that is the true office and work of philosophy which, not trusting too much to the faculties of the mind, does not lay up the matter, afforded by natural history and mechanical experience, entire or unfashioned in the memory, but treasures it after being first elaborated and digested in the understanding. And, therefore, we have a good ground of hope, from the close and strict union of the experimental and rational faculty, which have hitherto been united." In the very place where the obscure passage occurs, he says, after speaking of the inauspicious divorce usually made between mind and nature—"The explanation of which things, and of the true relation between the nature of things and the nature of the mind, is as the strewing hension, not to the infinite capacities of nature to be apprehended; and it is a great error to assert that the sense is the measure of things. But by his method of effecting, as completely as possible, a reconciliation between the subjective and objective, he hoped to have "established for ever a true and lawful marriage between the empirical and the rational faculty, the unkind and ill-starred divorce and separation of which has thrown into confusion all the affairs of the human family." The mind that is in harmony with the laws of nature, in an intimate sympathy with the course of events, is strong with the strength of nature, and is developed by its force: it is the identification of subject and object, which men have so long and so mischievously laboured to divorce. For there are not two worlds—a world of nature and a world of human consciousness standing over against one another, but one world of nature whereof human consciousness is an evolution and, may we not say, a consummation. The aim and labour of man should be to identify himself with nature by intimate communion therewith, not to place himself in a position of separation and antagonism under the delusion of a monstrous *manie de grandeur*.

A contemplation of the earlier stages of human development as exhibited by the savages, certainly constrains the admission that the conscious or designed co-operation of the mind in the adaptation of man to external nature was not great. The fact is, however, in exact conformity with what has already been asserted concerning the nature and domain of consciousness. Assuredly it is not consciousness, the natural result of a due development, which gives the impulse to development;

and decoration of the bridal chamber of the Mind and Universe, the Divine Goodness assisting; out of which marriage let us hope (and this be the prayer of the bridal song) there may spring helps to man, and a line and race of inventions that may in some degree subdue and overcome the necessities and miseries of humanity."

conscious method has had no greater part in the formation of a moral sense in the later epochs than it probably had in the discovery of fire and its uses in the earlier epochs of human evolution. Whence comes the impulse of evolution on earth we know not; but certainly from a source that is past finding out by our finite apprehension—from the primeval central Power which hurled the planets on their courses, and holds the lasting orbs of heaven in their just poise and movement. In virtue of the fundamental impulse of its being, mankind struggles, at first blindly, towards a knowledge of and adaptation to external nature, until that which has been insensibly acquired through generations becomes an inborn addition to the power of the mind, and that which was unconsciously done becomes conscious method.

It were well, then, that this idea took deep and firm root in our thoughts: that the development of mind, both in the individual and through generations, is a gradual process of organization—a process in which Nature is undergoing her latest and most consummate development through man. In reality we do not fail virtually to recognise this in the case of language, the organic growth of which, as we scientifically trace it, is the result of the unseen organization of thought that lies beneath, and alone gives it meaning. His own consciousness, faithfully interpreted, might suffice to reveal to each one the gradual maturing or becoming through which a process of thought continually goes in his mind. So has it been with mankind: at first there was an instinctive or pure organic development, the human race struggled on, as the child does, without being conscious of its *ego*; then, as it reached a certain stage of development, it became, as the youth does, exceedingly self-conscious, and an extravagant and unhealthy metaphysical subjectivity was the expression of an undue self-feeling; and finally, as the happily developing individual passes from an undue subjectivity to a calm objective manner of viewing things, so Bacon may be said to mark the epoch of a corresponding happy change in the development of mankind. Let us entirely get rid, however, of the notion that the objective study of nature means merely the sensory perception of it; we see, not with the eye, but through it; and to any one who is above the level of the animal the sun is not a bright disc of fire about the size of a big cheese, but an immense orb rushing through space with its attendant planetary system at the rate of some hundreds of thousands of miles a day. Now, such are the wondrous harmony, connection, and continuity pervading that mysterious whole which we call Nature, that it is impossible to get a just and clear idea of one pure circle of her works without that idea becoming most useful in flashing a light into obscure and unknown regions, and in thus aiding the conscious establishment of a further harmony of adaptation between man and nature.* Hence we anticipate observation by far-reaching deductions, foreseeing facts that are abstractly included in the pure circle of a true general intuition, and which, when observed, are the verification of our deduction. The brilliant insight or intuition of the man of genius, who so often anticipates the slow result of systematic investigation, witnesses with singular force to that truth. Far wiser than many of his commentators have been, Bacon accordingly failed not to appreciate clearly the exceeding value of idea in the interpretation of nature.

But if the due co-operation of the mind is necessary, if the harmony of subjective and objective was Bacon's real method, in the prosecution of physical science, how much more useful must the just union of the empirical and rational faculties be in the study of mental science; the task then being to apply the ideas of the mind to the interpretation of the mind's processes of activity. It must assuredly be allowed that the light of one's own train of thought is often most serviceable in interpreting the mind of another person; so much so, indeed, that one may know what is passing therein with not less certainty, sometimes even with greater certainty, than when it is actually uttered. In order to be successful in this sort of intuition, not only good natural insight, but a large experience of life and men, is most necessary, else the most grievous mistakes may be made; here, as elsewhere, power is acquired by intending the mind to external realities, by submitting the understanding to things. This then is objective observation; if strictly subjective, it must be limited to the revelations of self-consciousness. Plainly, too, this objective application of our ideas to the interpretation of another mind is a very different matter from the deliberate direction of consciousness to its own states,—that introspective analysis of the processes of thought whereby, as before said, the natural train of ideas being interrupted and the tension of a particular activity maintained, an artificial state of mind is produced, and a tortured self-consciousness, like an individual put to the torture, makes confessions that are utterly untrustworthy, most often giving the exact answer which the torture was applied to extract. The genuine utterances of his inner life, or the sincere and direct revelations of the man of great natural ability and good training, are the highest truths—but the contradictory anatomical revelations of internal analysis by the professed psychologists are the vainest word jugglings with which a tenacious perseverance has vexed a long-suffering world. They should justly be opposed, as by Bacon; or shunned, as by Shakespeare; or abhorred, as by Goethe:—"Ich habe nie an Denken gedacht."[*] As

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* "Denn wo Natur im reinen Kreise waltet ergreifen alle Welten sich."
GOETHE, *Faust.*

[*] Hiebei bekenn' ich dass mir von jeher die grosse und so bedeutend klingende Aufgabe: *erkenne dich selbst*, immer verdäch-

in the child there is no consciousness of the *ego*, so in the highest development of humanity, as represented by these our greatest, a similar unconsciousness of the *ego* seems to have been reached; and the individual, in intimate and congenial sympathy with nature, carries forward its organic evolution with a child-like unconsciousness and a child-like success.

To prevent misunderstanding, let me say, although what has gone before in this chapter should render it unnecessary, that I have no absurd desire to repudiate introspective observation entirely; I aspire only to see it dethroned from the exclusive place which it has usurped, and relegated to its proper place in the study of mental science. One ought perhaps to distinguish systematically between the simple revelations of mental states in consciousness, which, coming from a well-trained mind, yield valuable aid to other methods of inquiry, and the empty results of the methodical application of introspective analysis to construct a self-sufficient philosophy of mind without regard to or aid from other methods. Everybody can perceive that feelings, ideas, volitions, are known through self-consciousness, and have only a subjective meaning. And although they may, and no doubt do, correspond to what, I suppose, we may call objective changes in the nervous system, we cannot know them by objective inquiry, any more than we can know the material changes by mental introspection. No observation of the brain, no investigation of its chemical activities, gives us the least information respecting the states of feeling that are connected with them; as has

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tig vorkam, als eine List geheim verbünder Priester, die den menschen durch unerreichbare Forderungen verwirren, und von der Thätigkeit gegen die Aussenwelt zu einern innern falschen Beschaulickeit verleiten wollten. Der mensch kennt sich selbst, in sofern er die Welt kennt, die er nur in sich und sich nur in ihr gewahr wird. Jeder neue Gegenstand, wohl beschaut, schliesst ein neues Organ in uns auf.—GOETHE, vol. 49-50.

been aptly remarked, it is certain that the anatomist and physiologist might pass centuries in studying the brain and nerves, without ever suspecting what a pleasure or a pain is, if they have not felt both; even vivisections teach us nothing except by the interpretation which we give them through observation of our own mental processes. Nevertheless, it would be rash to declare that the energies which in consciousness are feelings, ideas and volitions will not sometime be appreciable and even measurable by delicate physical instruments which may yet be invented, not otherwise than as certain phenomena accompanying conduction along a nerve-track are now appreciable and measurable by the galvanometer. The question for psychology is how we are to observe in detail, and ascertain definitely, the correspondences between the subjective states which are known by self-consciousness and the objective changes in brain to which they run parallel, and which we believe to be the physical conditions of them. In the same way, I answer, as we establish correspondences in physical phenomena—by observation and experiment. Our aim must be to study carefully the differences between the brains of the lower animals, between the brain of the animal and the human brain, and between different human brains, and to compare the observed differences in structural development with the carefully studied differences in mental functions; to observe what loss or modification of mental function in an animal follows the removal or the experimental modification of a particular portion of brain; and to take advantage, for the same purpose, of the pathological experiments upon the human brain which are made for us by disease and by accidental injuries.

But granted, it may be said, you will eventually succeed in establishing an exact sequence of a particular mental state to a particular change in brain—nay, perhaps, of all the special mental states to their special cerebral changes, you are still no nearer explaining *why* the energy which follows the cerebral change is a feeling, or an idea, or a volition—why it becomes conscious. That is so, no doubt: but at the same time we are no worse off in that respect than we are in respect of other natural forces, such as electricity and chemical affinity, and the changes in matter to which they are sequent; all of which sequences, as known to us, it may be remarked, are only states of consciousness. You do not ask us to explain why chemical affinity or electricity is what it is, nor demand that we should do more than establish the invariable relation between matter and force: why then make such an unwarrantable demand only when cerebral organization functions as conscious energy? We have done enough, we contend, when we have established invariable sequence—when we have definitely ascertained in respect of each mental function, that a particular state of cerebral matter is the invariable condition of it—that when this varies it varies, and when this is not it is not; and we may certainly claim the right to exult, should it ever come to pass, as it may well be it will, that we succeed in appreciating by delicate mechanical instruments the energies which appear in consciousness as feelings, ideas and volitions, and in measuring the variations of them. The true method of psychology is the union of the subjective and objective methods, or rather the rigorous prosecution of the objective method interpreted by subjective light. This is the happy bridal union from which we may expect vigorous offspring. There is not one science of psychology, another science of cerebral physiology, and between them a science of physiological psychology: there are not three sciences, but one science—that of the physiology of the nervous system, the phenomena whereof have an objective and a subjective aspect, and are to be studied by external and internal observation. Mind and nature are, as Aristotle pointed out long ago, really two sides of the same fact, which are only separable verbally.

Before concluding this chapter it may be well distinctly to affirm a truth which is an unwelcome one, because it flatters not the self-love of mankind; and it is this, that there is all the difference in the world between the gifted man of genius, who can often anticipate the slow results of systematic investigation, and who strikes out new paths, and the common herd of mortals, who must plod on with patient humility in the old tracks, "with manifold motions making little speed:" it is the difference between the butterfly which flies and feeds on honey and the caterpillar which crawls and gorges on leaves. Men, ever eager to "pare the mountain to the plain," will not willingly confess this; nevertheless it is most true. Rules and systems are necessary for the ordinarily endowed mortals, whose business it is to gather together and arrange the materials; the genius, who is the architect, has, like nature, an unconscious system of his own. It is the fate of its nature, and no demerit, that the caterpillar must crawl: it is the fate of its nature, and no merit, that the butterfly must fly. The question, so much disputed, of the relative extent of applicability of the so-called inductive and deductive methods, often resolves itself into a question as to what manner of man it is who is to use them—whether one who has senses only, who has eyes and sees not, or one who has senses and a soul; whether one who can only collect so-called facts of observation, or one who can bind together the thousand scattered facts by the organizing idea, and thus guarantee them to be facts. Plato, Shakespeare, Goethe, Humboldt, Bacon too, and, in truth, all men who have had anything of inspiration in them, were not mere sense-machines for registering observations, but rather instruments on which the melody of nature, like sphere music, was made for the benefit and delectation of such as have ears to hear.

That some so virulently declaim against theory is as though the eunuch should declaim against lechery: it is the chastity of impotence.

In no case, however, can the inductive and deductive methods be separated; and it would be a great error to suppose that the highest genius can dispense with long and patient industry in observation. The well-endowed and well-trained natural philosopher is pleased when a strange and novel fact presents itself, because it is calculated to arrest the routine of observation and reflection, and to set him to work on a new path to bring it under known laws or to discover the new law of which it is a result; accordingly he is careful not to pass it by, but observes it earnestly, holding to it tenaciously, associates or compares it with other facts of a like nature which have come within his experience, frames a theory or hypothesis concerning it, deduces other facts which must *be* if the hypothesis were true, and finally tests the deduction by rigid comparison of the facts inferred with the results of patient observation and varied experiment. It is probable that he forms many erroneous hypotheses, and abandons them after trial, before he hits upon the true one which he verifies. "The world little knows," wrote Faraday, "how many of the thoughts and theories which have passed through the mind of a scientific investigator have been crushed in silence and secrecy by his own severe criticism and adverse examination; that in the most successful instances not a tenth of the suggestions, the hopes, the wishes, the preliminary conclusions have been realized." The qualities necessary to the successful discoverer appear then to be these: first, an impressionability to, and determined observation or mental registration of, a novel phenomenon: secondly, a fruitful faculty of discerning relations of identity and of thereupon framing hypotheses; and, lastly, persistent industry in following out the consequences of an hypothesis, by foreseeing its results and devising experiments to test and verify them. Patient observation and industry may no doubt be acquired by ordinary training, but the faculty of detecting identity and uniformity in different objects and events, and the fruitful imagination which frames hypotheses and devises means of verification, are not within the reach of everybody; they are more or less qualities of original nature. Each generation has a common heritage of ideas, and an individual mind finds itself in a certain atmosphere of thought which it reflects more or less distinctly. He who has what is called genius is in harmony with and assimilates the best thought of his own epoch and of preceding epochs, and carries it forward to a higher evolution. An age which lacks that impulse of evolution which the genius embodies, is apt to harden into obstructive formula.

So rarely, however, does nature produce one of these men gifted with that high and subtile quality called genius—being scarce, indeed, equal to the production of one in a century—and so self-sufficing are they when they do appear, that we, gratefully accepting them as visits of angels, or much as Plato accepted his supercelestial ideas, need not vainly concern ourselves about their manner of working. It is not by such anxious troubling that one will come; it is not by introspective prying into and torture of its own self-consciousness that mankind evolves the genius; the mature result of its unconscious development flows at due time into consciousness with a grateful surprise, and from time to time the slumbering centuries are thus awakened. It is by the patient and diligent work at systematic adaptation to the external by the rank and file of mankind; it is by the conscientious labour of each one, after the inductive method, in that little sphere of nature, whether psychical or physical, which in the necessary division of labour has fallen to his lot—that a condition of evolution is reached at which the genius bursts forth. Tiresome, then, as the minute man of observation may sometimes seem as he exults over his scattered facts as if they were final, and magnifies his molecules into mountains as if they were eternal, it is well that he should thus enthusiastically esteem his work; and no one but will give a patient attention as he reflects how indispensable the humblest unit is in the social organism, and how excellent a spur vanity is to industry. Not unamusing, though somewhat saddening, is it, however, to witness the painful surprise of the man of observation, his jealous indignation and clamorous outcry, when the result at which he and his fellow-labourers have been so patiently, though blindly, working, when the genius-product of the century which he has helped to create, starts into life—when the metamorphosis is completed and the caterpillar has become a butterfly: amusing, because the patient worker is supremely astonished at a result which, though preparing, he nowise foresaw; saddening, because individually he is annihilated, and all the toil in which he spent his strength is swallowed up in the product which, gathering up the different lines of investigation and thought, and giving to them a unity of development, now by epigenesis ensues. We perceive, then, how it is that a great genius cannot come save at long intervals, as the tree cannot blossom but at its due season; and how, when he comes, he reaches his hand across the silent years, from the height on which he stands, to the great ones who have gone before him, and are similarly lifted up on high as lights to lighten the paths of the toiling multitudes in the valleys and on the plains below.

But why should any one, great or little, fret and fume because he is likely soon to be forgotten? What more is the individual than a passing phase of being; and what matters it if he be forgotten in life or death? The work which he has done, whether it has been good or bad, will in no case be forgotten of the universe. It were an excellent physic to vanity for a man to consider his littleness in relation to mankind; to pass thence to a consideration of himself in relation to the world's history; and to complete the humbling reflection by considering himself in relation to the universe. The genius himself, as individual, is after all of but little account; it is only as the birth of the travailing centuries that he exists, only so far as he is a true birth of them and adequately representative that he is of value: the more individual he is, the more transitory is his fame; the more completely representative he is, the less original he is. When he is immortal, he has become a mere name marking an epoch of thought, and no longer an individual. What is the fame of him who first discovered fire and its uses? What the fame of him who first taught men to plant wheat: an invention which the ancient Greeks thought too much for human wit, and attributed, as we do the generation of a moral sense, to Divine aid. It is useful to label a discovery with a name, in order to mark its date in the development of a science; but it is not one man's, it is many men's.[*] Whosoever, in a foolish conceit of originality, strains after novelty and neglects the scattered and perhaps obscure labours of others who have preceded him, or who are contemporaneous with him; whosoever, over-careful of his individual fame, cannot carry forward his own evolution with a serene indifference to neglect or censure, but makes puerile demands on the approbation of the world—may rest content that he is not a complete birth of the age, but more or less an abortive monstrosity: the more extreme he is as a monstrosity, the more original must he needs be. It is a strange comedy when men contend for priority in discovery so eagerly as they do, often the while making scanty acknowledgment of what they owe to the past; what would they say if, when the time of flowering had come, a rosebud were to call all rose-trees to take notice that it was the first to blossom on its tree, and to witness the great wrong that was done to it by the roses which confessed not that they had learnt from it how to blossom after their kind?

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[*] Und doch ziehen manchmal gewisse Gesinnungen und Gedanken schon in der Luft umher, so dass mehrere sie erfassen können. Immanet aer sicut anima communis quæ omnibus præsto est et quâ omnes communicant invicem. Quapropter multi sagaces spiritus ardentes subito ex aere presentiscunt quod cogitat alter homo. Oder, um weniger mystisch zu reden, gewisse Vorstellungen werden reif durch eine Zeitreihe. Auch in verschiedenen Gärten fallen Früchte zu gleichen Zeit von Baume.—GOETHE.

Viele Gedanken heben sich erst aus der allgemeinen Cultur hervor wie die Blüthen aus den grünen Zweigen. Zur Rosenzeit sieht man Rosen überall blühen.—GOETHE.

Viewing mental development, whether in the individual or in the race, as a process of organization, as the consummate display of nature's organic evolution, and recognising, as we must do, the most favourable conditions of such evolution to be the most intimate harmony between man and nature, I may rightly conclude, so far as concerns the rule of a conscious method of inquiry, with the ancient and well-grounded maxim—"Learn to know thyself in nature, that so thou mayest know nature in thyself."(8)

NOTES.

[1] (*p.* 6).—"Insomuch that many times not only what was asserted once is asserted still, but what was a question once is a question still, and instead of being resolved by discussion, is only fixed and fed."—BACON, *Proleg. Inst. Magn.*

[2] (*p.* 18).—The received psychology M. Comte calls an "illusory psychology, which is the last phase of theology," and says that it "pretends to accomplish the discovery of the laws of the human mind by contemplating it in itself; that is, by separating it from

causes and effects." (Miss Martineau's Translation, p. 11.) Again, he says: "In order to observe, your intellect must pause from activity; yet it is this very activity that you want to obsreve. If you cannot effect the pause, you cannot observe; if you do effect it, there is nothing to observe. The results of such a method are in proportion to its absurdity." (Ibid. p. 11.)

[3] (*p.* 19).—"But the truth is, that they are not the highest instances which give the best or securest information, as is expressed, not inelegantly, in the common story of the philosopher, who, while he gazed upon the stars, fell into the water; for if he had looked down, he might have seen the stars in the water, but, looking aloft, he could not see the water in the stars."—*De Augment. Scient.* B. ii.

[4] (*p.* 23).—*Individual Psychology* Bacon set down as wanting; he enforces its study, "so that we may have a scientific and accurate dissection of mind and characters, and the secret dispositions of particular men may be revealed, and that from the knowledge thereof better rules may be framed for the treatment of the mind."—*De Augment. Scient.* B. vii.

[5] (*p.* 27).—Beneke lays it down as a fundamental law of mental development "dass Alles was als Akt in ihr erzeugt wird, auch wenn es aus dem Bewusstsein oder Erregtheit der Seele entschwindet, doch innerlich fortexistirt, und in die späteren gleichartigen Akte als Unterlage hineingegeben wird."—*Pragmatische Psychologie*, p. 24.

What is the nature of this functional disposition of nerve-element which is produced by previous function, we know not. It is clear that we give no explanation of it by calling it so, any more than we do by describing it, as Beneke did, as a residuum or vestige of previous activity, or, as was done by certain German writers, as potential or unconscious idea. Objections to the supposition of unconscious idea laid by inactive in the mind or brain are not far to seek. "Ideas," Mr. Herbert Spencer remarks (*Principles of Psychology*, vii. p. 485), "are like the successive chords and cadences brought out from a piano, which successively die away as other ones are sounded. And it would be as proper to say that these passing chords and cadences thereafter exist in the piano, as it is proper to say that passing ideas thereafter exist in the brain. In the one case, as in the other, the actual existence is the structure which, under like conditions, again evolves like combinations. . . . . The existence in the subject of any other ideas than those which are passing, is pure hypothesis absolutely without any evidence whatever." This analogy, when we look into it, seems more captivating than it is complete. What about the performer in the case of the piano and in the case of the brain respectively? Is not the performer a not unimportant element, and necessary to the completeness of the analogy? The passing chords and cadences would have small chance of being brought out by the piano if they were not previously in his mind. Where, then, in the brain is the equivalent of the harmonic conceptions in the performer's mind? If Mr. Spencer supposes that the individual's mind, his spiritual entity, is detached from the brain, and plays upon its nervous plexuses, as the performer plays upon the piano, his analogy is complete; but if not, then he has furnished an analogy which those who do take that view may well thank him for. There is this difference between the passing chords and cadences of the piano and the passing chords and cadences in the brain—and it is of the essence of the matter—that, in the former case, the chords and cadences do pass and leave no trace of themselves behind in the structure of the piano; while, in the latter case, they do not pass or die away without leaving most important after-effects in the structure of the brain; whence does arise in due time a considerable difference between a cultivated piano and a cultivated human brain, and whence probably have arisen, in the progress of development through the ages, the differences between the brain of a primeval savage and the brain of Mr. Spencer. Those who speak of latent ideas do, therefore, endeavour to denote thereby an important something which Mr. Spencer's analogy leaves out of sight. With the brain, function makes faculty; not so with the piano.

Another objection to the doctrine of unconscious ideas, is that we only know ideas through consciousness, and consciousness through ideas; the expression, unconscious idea, is as absurd therefore as that of unconscious consciousness. If to this it be replied that the energies which appear in consciousness as ideas may certainly be sometimes excited into activity, and have their effect upon thought or upon movement, without our consciousness, it may be said that we do wrong to call them ideas in such case; and even if we do call them so, they are still active ideas, and that the question is not of such, but of so-called ideas that are laid by inactive. It is this which is the absurdity; for the idea, like the definite movement of muscle, is the function not the structure, not the statical element but the element in action; we might as well speak of the movement of blowing the nose as being laid up inactive in the muscles or their nerve-centres (which, after all, in a certain sense it is, for the young child can't blow its nose), as talk of unconscious ideas stored up in the mind. Inactive idea is, in fact, inactive action, a contradiction in terms. And this brings us to the objection to speaking of the functional disposition as a residuum or trace; that it is plainly not a portion of the idea which is left behind, that there is no resemblance between the idea and the modification of material element which follows it, and that it is therefore improper to call this modification a residuum of idea. When the potentiality becomes energy, when the structure is in function, then only is there idea. It is Wundt (*Grundzüge der physiologischen Psychologie*, pp. 712 and 790) who proposes to speak of it as functional disposition. When we endeavour to form an intuition of its nature, we are met with the difficulty of figuring to the senses what takes place in such new, obscure, and yet impenetrable regions of minute activities as the molecular processes of nerve-function; we are driven to have recourse to the coarser experiences of the senses for the materials of an intuition, which is accordingly coarse and inadequate.

[6] (*p.* 28).—The most interesting description of the feelings that accompany death by drowning, occurs in a letter from Rear-Admiral Sir F. Beaufort to Dr. Wollaston:—

"From the moment that all exertion had ceased—which I imagine was the immediate consequence of complete suffocation—a calm feeling of the most perfect tranquillity superseded the previous tumultuous sensations; it might be called apathy, certainly not resignation, for drowning no longer appeared to be an evil. I no longer thought of being rescued, nor was I in any bodily pain. On the contrary, my sensations were now rather of a pleasurable cast, partaking of that dull but contented sort of feeling which precedes the sleep produced by fatigue. Though the senses were thus deadened, not so the mind; its activity seemed to be invigorated in a ratio which defies all description, for thought rose above thought with a rapidity of succession that is not only indescribable, but probably inconceivable by any one who has not been in a similar situation. The course of these thoughts I can even now in a great measure retrace—the event which had just taken place—the awkwardness that had produced it, the bustle it had occasioned, the effect it would have on a most affectionate father, the manner in which he would disclose it to the rest of the family, and a thousand other circumstances minutely associated with home, were the first series of reflections that occurred. They took then a wider range, our last cruise, a former voyage and shipwreck, my school, the progress I had made there, and the time I had misspent, and even all my boyish pursuits and adventures. Thus travelling backwards, every past incident of my life seemed to glance across my recollection in retrograde succession; not, however, in mere outline and collateral feature. In short, the whole period of my existence seemed to be placed before me in a kind of panoramic review, and each act of it seemed to be accompanied by a consciousness of right and wrong, or by some reflection on its cause or its consequences; indeed, many trifling events which had long been forgotten, then crowded into my imagination, and with the character of recent familiarity. . . . . The length of time that was occupied with this deluge of ideas, or rather the shortness of time into which they were condensed, I cannot now state with precision: yet certainly two minutes could not have elapsed from the moment of suffocation to the time of my being hauled up."

In the *Confessions of an Opium Eater* (p. 261), De Quincey relates how, when dreaming under the influence of opium, he remembered things which, when waking, he could not have recognized as parts of his former experience, and remembered them with all the feelings of the original experience; and thereupon quotes a surmise that the book which shall be opened at the day of judgment is the everlasting roll of remembrance. "The minutest incidents of my childhood, or forgotten scenes of later years, were often revived. I could not be said to recollect them; for, if I had been told of them when waking, I should not have been able to acknowledge them as parts of my past experience. But placed as they were before me in dreams like intuitions, and clothed in all the evanescent circumstances and accompanying feelings, I *recognized* them instantly. . . . . Of this, at least, I feel assured, that there is no such thing as ultimate forgetting; traces once impressed upon the memory are indestructible; a thousand accidents may and will interpose a veil between our present consciousness and the secret inscriptions of the mind. Accidents of the same sort will also rend away this veil. But alike, whether veiled or unveiled, the inscription remains for ever; just as the stars seem to withdraw before the common light of day, whereas, in fact, we all know that it is the light which is drawn over them as a veil; and they are waiting to be revealed, whenever the obscuring daylight itself shall have withdrawn." One is tempted to add the question from Blanco White's *Sonnet:*—

"If Light may thus deceive, wherefore not Life?"

[7] (*p.* 41).—"It is to be regretted that he (Dugald Stewart) had not studied (he even treats it as inconceivable) the Leibnitzian doctrine of what has not been well denominated *obscure perceptions or ideas*—that is, acts and affections of mind, which, manifesting their existence in their effects, are themselves out of consciousness or *apperception*. The fact of such latent mental modifications is now established beyond all rational doubt; and on the supposition of

their reality, we are able to solve various psychological phenomena otherwise inexplicable. Among these are many of those attributed to habit." (Sir W. Hamilton, in his edition of Reid, p. 551.)

"Daraus, dass die Seele des Gedankens sich nicht bewusst sei, folge noch gar nicht, dass sie zu denken aufhöre." (*Neue Versuche üb. d. menschlich. Verstand.* B. ii.

"Ich sehe nicht," says Leibnitz, again, "dass die Cartesianer jemals beweisen haben oder beweisen können, dass jede Vorstellung von Bewusstsein begleitet ist." And again:—"Darin nämlich haben die Cartesianer sehr gefehlt, dass sie die Vorstellungen, deren man sich nicht bewusst ist, für nichts rechneten. Das war auch der Grund, warum sie glaubten, dass nur die Geiste onaden waren, und dass es keine Seelen der Thiere oder andere Entelechien gebe."—*Leibnitz als Denker. Auswahl seiner kleinern Aufsätze.* By G. Schelling. Pp. 108 and 115.

He was the first to assert the existence of "unconscious perceptions or ideas," and he assigned them a high importance. The phrase may seem paradoxical, but the contradiction is perhaps only apparent. For if we only know what we are conscious of, and know nothing of which we are not conscious, what right have we to declare of the existence which we know by or in consciousness, that it can have no existence out of consciousness? "Vorstellungen zu haben, und sich ihrer doch nicht bewusst zu sein, darin scheint ein Widerspruch zu liegen. Allein wir können uns doch mittelbar bewusst sein, eine Vorstellung zu haben, ob wir gleich unmittelbar uns ihrer nicht bewusst sein."—KANT, *Anthropologie.* Quoted by Hartmann: *Philosophie des Unbewussten.* Vol. i. p. 13.

Fichte, in his *Bestimmung des Menschen*—"In jedem Momente ihrer Dauer ist die Natur ein zusummenhängendes Ganze; in jedem Momente muss jeder einzelne Theil derselbe so sein wie er ist, weil alle übrigen sind wie sie sind; und du könntest kein Sandkörnchen von seiner Stelle verrücken, ohne dadurch vielleicht alle Theile des unermesslichen Ganzen hindurch etwas zu verändern. Aber jeder Moment dieser Dauer ist bestimmt durch alle abgelaufenen Momente, und wird bestimmen alle künftigen Momente, und du kannst in dem gegenwärtigen keines Sandkörne Lage anders denken als sie ist, ohne dass du genöthigt würdest die ganze Vergangenheit ins Unbestimmte hinauf, und die ganze Zukunft ins Unbestimmte herab dir anders zu denken."—*Sämmtliche Werke,* ii. 178.

It is only right to add, that the fullest exposition of unconscious mental action is to be found in Beneke's works. A summary of his views is contained in his *Lehrbuch der Psychologie als Naturwissenschaft.*

[a] (*p.* 69).—I leave this note as it stood in the first edition (1867). Then the criticism was thought by some to be hardly just; indeed, it has not escaped censure. There are few persons, I suspect, who would not endorse it now in its application to Mill.

Since this chapter was written, and, indeed, separately published, Mr. J. S. Mill has made a powerful defence of the so-called Psychological Method. In his criticism of Comte in the *Westminster Review* for April 1865, and in his "Examination of Sir W. Hamilton's Philosophy," he has said all that can be said in favour of the Psychological Method, and has done what could be done to disparage the Physiological Method. This he had already done many years ago in the second volume of his "System of Logic," and he is now only consistent in returning to the charge. Nevertheless, the admirers of Mr. Mill may well experience regret to see him serving with so much zeal on what is a so desperately forlorn hope. Physiology seems never to have been a favourite study with Mr. Mill—in none of his writings does he exhibit any indications of being really acquainted with it; for it is hardly possible to conceive that any one having a knowledge of the present state of this science, would disparage it as he has done, and exalt so highly the psychological method of investigating mental phenomena. The wonder is, however, that he who has done so much to expound the system of Comte, and to strengthen and complete it, should on this question take leave of it entirely, and follow and laud a method of research which is so directly opposed to the method of positive science. Of course, I speak now strictly of the method, not of Comte's application of it in his unfounded phrenological speculations, which are scarcely less wild and absurd than his religious delirium appears to be. [Not really so wild as I rashly imagined—that comes of giving an opinion of an author without having read him properly.] However, though one may suspect Mr. Mill to be unfortunate in his ignorance, or entirely mistaken in his estimate, of the physiological method, one cannot fail to profit by the study of his arguments on behalf of the psychological method, and by his exposition of its merits. By parading the whole force of the reasons in favour of it, he has exhibited, not so much its strength as its weakness, and has undesignedly given important assistance to the physiological method. For the reasons why he has not been convincing, and why this chapter has been left unmodified, I may refer to the arguments set forth in a review of his "Examination of Sir W. Hamilton's Philosophy" in the *Journal of Mental Science* for January 1866. "Mr. Mill," it is there said, "has a high opinion of the psychological method of inquiry into mental phenomena, and thinks Comte to have committed a great error in discarding it. Whether that be true or not is not the question now; we may admit it to be true, and still ask whether it is a sufficient reason for ignoring those important results of the physiological method of research which bear vitally on psychology; whether, in fact, because a certain method has some worth, it can therefore afford to dispense entirely with the aid furnished by other methods."

And again:—"The present complaint against Mr. Mill is that he takes no notice of the effects of recent scientific conceptions on the questions referred to philosophy; that he goes on exactly as he might have gone on if he had lived in the days of Aristotle; that at a time when a new method, highly fertile in fact and of more fruitful promise, was available, he persists in trying to do, by the old method, what Plato, Descartes, Locke, Berkeley, and a host of others have not done. Now, we have not the slightest faith that ten thousand Mills will, following the same method, do what these great men have not done; but there can be no question that, had Mr. Mill chosen to avail himself of the new material and the new method, which his great predecessors had not in their day, he would have done what no other living man could have done."

CHAPTER II.

THE MIND AND THE NERVOUS SYSTEM.

"*That which perceives* is a part of nature as truly as the objects of *perception* which act on it, and, as a part of nature, is itself an object of investigation purely *physical.* It is known to us only in the successive changes which constitute the variety of our feelings: but the regular sequence of these changes admits of being traced, like the regularity which we are capable of discovering in the successive organic changes of our bodily frame. There is a *Physiology of the Mind*, then, as there is a *Physiology of the Body*—a science which examines the phenomena of our spiritual part simply as phenomena, and from the order of their succession, or other circumstances of analogy, arranges them in classes under certain general names; as, in the physiology of our corporeal part, we consider the phenomena of a different kind which the body exhibits, and reduce all the diversities of these under the names of a few general Functions."—*Sketch of a System of Philosophy of the Human Mind*, by T. Brown, M.D.

THE crude proposition that the brain secretes thought as the liver secretes bile has been the subject of much ridicule to those who have not received it with outcries of disapprobation and disgust.* Assuredly it is not an exact expression of the facts; one may rightly admit the brain to be the principal organ of mind without accepting the fallacious comparison of mental function with biliary secretion. Here as elsewhere, confusion is bred by the common use of the word "secretion" to express, not only the functional process but the secreted product, both the insensible vital changes and the tangible results of them. Let us begin with the endeavour to fix, with as much precision as possible, what we mean by mind.

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* "Nous concluons avec la même certitude que le cerveau digére en quelque sort les impressions; qu'il fait organiquement la sécrétion de la pensée."—*Rapport du Physique et du Moral de l'Homme*, par P. J. G. Cabanis.

In the first place, mind, viewed in its scientific sense as a natural force, cannot be observed and handled and dealt with as a palpable object; like electricity, or gravity, or any other of the natural forces, it is appreciable only in the changes of matter which are the conditions of its manifestation. Few, if any, will now be found to deny that with each display of mental power there are correlative changes in the material substratum; that every phenomenon of mind is the result, as manifest energy, of some change, molecular, chemical, or vital, in the nervous elements of the brain. But we have to deal here with matter the chemical nature of which is extremely complex and obscure; for notwithstanding the labour which has been given to the chemical analysis of the brain and nervous system, and, notwithstanding that we are sure of its chemical elements, very little is yet known exactly of the actual composition of nerve element. This much, however, is certain: that its constituents are of a very complex character, easily undergo decomposition, and, being compounded largely of carbon and hydrogen, have a high oxidation value. It is probable that a chemical synthesis is effected in the substance of nerve, through which the nutrient material brought by the blood is finally converted into highly complex and unstable albuminoid compounds; these representing a great value of potential energy, which becomes actual through their decomposition during function. The compounds named Cerebrin, Cerebrinic acid, Lecithin, and the various fats containing phosphorus, which have been discovered in the brain, have been supposed, indeed, to be derived from the disintegration of a more complex substance named Protagon, having a chemical composition represented by the formula $C_{232} H_{240} N_4 PO_{44}$.[*] Whether that be so or not must be decided by future research; meanwhile, we are content to believe that without oxidation we can no more have thought from brain than we can have flame from fuel.

The so-called extractives of nerve further testify to change or retrograde metamorphosis through functional activity; for there are found lactic acid, kreatin, uric acid, probably also hypoxanthin, and, representing the fatty acids, formic and acetic acids. These products are like those which are found in muscle after its functional activity: in the performance of an idea, as in the performance of a movement, there is a retrograde metamorphosis of organic element; the display of energy is at the cost of highly organized matter, which undergoes degeneration or passes from a higher to a lower grade of being; and the final retrograde products are, so far as is at present known, somewhat similar in muscle and nerve. While the contents of nerves, again, are neutral during rest in the living state, they become acid after death and after great activity during life: the same is the case also with regard to muscle.[†] Furthermore, after prolonged mental exercise, the products of the disintegration of nerve element, into the composition of which phosphorus enters largely, are recognised in an increase of phosphates in the urine; while it is only by supposing an idea to be accompanied by a correlative change in the nerve-cells that we can explain the exhaustion following excessive mental work and the breaking down of the brain in extreme cases.

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[*] The constitution of Lecithin has been represented by the formula $C_{44} H_{90} NPO_9$; that of Cerebrin by the formula $C_{37} H_{33} NO_3$.

[†] During putrefaction the brain furnishes acid products, among which are recognised oleic, margaric, phosphoglyceric and phosphoric acids.

These things being so, what is it which in a physiological sense we designate mind? Not the material products of cerebral activity which pass as excretions into the blood, but the marvellous energy which cannot be grasped and handled. The energy which is mind may more properly be compared with the energy which is muscular function. Here, then, is manifest a fallacy of the statement that the brain secretes thought as the liver secretes bile. It is plain that the tangible results of the brain's activity, the waste matters which pass into the blood for assimilation by tissues of a lower kind and for ultimate excretion from the body, might not less rightly be called the secretion of the brain, and be compared to the bile, than the intangible energy displayed in the mental phenomena.

That there is a consumption of matter during function, not otherwise than as there is a consumption of fuel in the steam-engine, and that the energy in both cases is produced thereby, is beyond doubt; but whether the substance of the nerve-cell itself suffers any waste is not so certain. It has been supposed that it is the material supplied by the blood which is chiefly consumed during function, not the substance of nerve-cell, in like manner as it is the fuel, not the steam-engine, which supplies the necessary force. But if this were so, why should the nerve-cell be so soon exhausted by work, and require repose in order to recruit—if we may not say, repair—itself? And why does function once exercised leave behind it a *disposition* to future function, unless there be some molecular disintegration of nerve which is made whole by nutrition? It is found by experiment that if the vagus nerve of an animal be stimulated, so as to make the heart beat slowly, it will continue to beat for a long time; but if galvanism be applied in such a way as to quicken the heart's pulsations, it quickly becomes exhausted and stops; owing, it would seem, to exhaustion of its motor nerve-centres, which stimulation of the vagus prevented by diminishing somehow the changes in them. Then again, the appearance of Lecithin and of the other similar complex compounds in such quantities as are met with in the brain would indicate that there is something more going on than a mere deposit of material from the blood and a consumption thereof—would point, in fact, to some disintegration of the nerve substance itself; so that it is certainly a legitimate supposition that they may be supplied to the brain ready made for consumption. However, similar compounds have been obtained from the blood, lymph, yolk of egg, and the spermatic fluid. By the old writers it was said that the "vital spirits" were secreted from the blood in the brain and were diminished or exhausted by frequent or prolonged use. With the necessary change of terms, that is probably very much what happens. The elements of nerve substance are secreted from the blood in the nerve-cells, and, undergoing decomposition during function, are diminished or exhausted by frequent or prolonged use. It may be that there is something in the nerve-cell which is fixed and forms a sort of permanent framework, and that a part is unstable and transitory, being perpetually decompounded during function and recompounded during rest. The fact is, that we cannot sever a nerve-cell from its medium; that which it takes into itself from the blood is an essential part of its nature and function—without it, it could not be a living nerve-cell; and it is to make an absolute division which exists not in nature when we affirm that the material consumed in function belongs either exclusively to the blood or to the nerve-cell.

Secondly, it is needful, in order to avoid confusion, to apprehend the exact signification of what is understood by the common and vague use of the word mind. It is really a general term acquired by observation of and abstraction from the manifold variety of mental phenomena: by such observation of the particular phenomena and appropriate abstraction from them we get, as an ultimate generalization, the general conception or the, so to speak, *essential idea* of mind. An illustration will help to exhibit what I mean. The steam-engine is a complicated mechanism, of the construction and mode of action of which many people know very little, but it has a very definite function of which those who know nothing of its construction can still form a sufficiently distinct conception; the co-ordinate integral action of the steam-engine, as we conceive it, is different from the nicely-adjusted mechanism, or from the action of any part of it. But the function of the engine is dependent on the mechanism and on the co-ordinate action of its parts, as well as on the supply of suitable fuel, cannot be dissociated from these, and has no real existence apart from them, though it may exist separately as a conception in our minds. By observation of the mechanism and appropriate abstraction we get the *essential idea* of the steam-engine, a fundamental idea of it, which, as our ultimate generalization, expresses its very nature as such, containing, as Coleridge would have said, "the inmost principles of its possibility as a steam-engine."

So likewise with regard to the manifold phenomena of mind: by observation of them and abstraction from the particular we get the general conception or the *essential idea* of mind, an idea which has no more existence out of the mind than any other abstract idea or general term. Because we can form the general conception of mind, it does not follow that mind can exist apart from the complex organization of the brain and its suitable blood-supply; we have no warrant in science or in logic for such an inference. In virtue, however, of that powerful tendency in the human mind to make the reality conformable to the idea, a tendency which has been at the bottom of so much confusion in philosophy, this general conception has been converted into an objective entity and allowed to tyrannize over the understanding. A metaphysical abstraction has been made into a spiritual entity, and a complete barrier thereby interposed in the way of positive investigation. Whatever be the real nature of mind —and concerning that it is as vain to speculate as concerning the real nature of gravitation, electricity, or chemical affinity—it is most certainly dependent for its every manifestation on the brain and nervous system; and now that scientific research is daily disclosing more clearly the relations between it and its organ, it is plainly most desirable to guard against the common metaphysical conception of mind, by recognizing the true subjective character of the conception and the mode of its origin and growth.

A third important consideration is that mental power is truly an organized result, not, strictly speaking, built up, but matured by insensible degrees in the course of life. The brain is not, like the liver, the heart and other internal organs, capable, from the moment of birth, of all the functions which it ever discharges; for while, in common with them, it has a certain organic function to which it is born equal, its high special character in man as the organ of conscious life, the supreme instrument of his relations with the rest of nature, is developed only by a long and patient education. Its functions are developed by education in the individual as they have been developed in the race by the gradual results of education through the ages. If we are inclined to feel surprise that so great a result should be accomplished in the individual in so short a time, we shall do well to reflect upon —first, the rich inheritance of other men's labour, 'the capitalized experiences,' which he has in the constitution of his brain; and, secondly, the vast amount of human labour and experience which is concentrated in what we call education—that is, in the means and appliances brought to bear even on the humblest child; for these means and appliances represent the accumulated acquisition of ages of human struggle. The very language which it is taught embodies the gains of countless ages of progressive adjustment of the human organism to its environment. Though the brain, then, is formed during embryonic life, its highest development only takes place after birth; and, as will hereafter appear, the same gradual progress from the general to the special which is exhibited in the development of the organ is witnessed in the development of our intelligence. How inexact and misleading in this regard, therefore, is any comparison between it and the liver!

Nevertheless, it must be distinctly laid down that mental action is as surely dependent on the nervous structure and its due supply of suitable blood as the function of the liver confessedly is on the hepatic structure and its blood-supply: that is the fundamental principle upon which the fabric of a mental science must rest.* The countless thousands of nerve-cells which form so great a part of the delicate structure of the brain are undoubtedly the centres of its functional activity: we know right well from experiment that the ganglionic nerve-cells scattered through the tissues of organs, as for example through the walls of the intestines and the structure of the heart, are centres of nerve force ministering to their organic action; and we may confidently infer that the ganglionic cells of the brain, which are not similarly amenable to observation and experiment, have a like function. Certainly they are not inexhaustible centres of self-generating force; they give out no more than what they have in one way or another taken in; they receive material from the blood, which they assimilate, or make of the same *kind* with themselves; a correlative metamorphosis of energy necessarily accompanying this upward transformation of matter, and the nerve-cell thus becoming, so long as its unstable equilibrium is preserved, a centre of statical power of the highest vital quality. The maintenance of the equilibrium of nerve element is the condition of latent thought —it is mind statical; the manifestation of thought involves the change or destruction of nerve element. The nerve-cell of the brain, it might in fact be said, represents statical thought, while thought represents dynamical nerve-cell, or, more properly, the energy of nerve-cell.

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* Strangely enough, some philosophers in Germany now maintain that the proposition "that all *conscious* mental activity can only take place as a function of the brain" is unassailable, but that it is not true of *unconscious* mental activity and of the impulses and intuitions which it produces. "Uber die unbewusste Geistesthätigkeit dagegen sagt er gar nichts aus, sie bleibt also, da alle Erscheinungen ihre Unabhängigkeit von den Hirnfunctionen beweisen, als etwas Selbstständiges bestehen, und nur die Form des Bewusstsein erscheint durch die Materie bedingt."—HARTMANN, p. 388, 3rd ed.

I do not go then farther than facts warrant when I declare the following propositions to be established in mental science:—(*a.*) When a thought occurs in the mind there necessarily occurs a correlative change in the grey matter of the brain; without it the thought could not arise, and with it cannot fail to arise. (*b.*) This change consists in a *movement* of some kind, which, in our present defect of knowledge, everyone may conceive of as he pleases. The nearest analogy is probably to be found in the compounds, and compounds of compounds, of vibrations in music; at any rate this analogy will help us, coarse and defective as it may be, to frame some kind of intuition of what takes place. Unzer called these movements *material ideas*, and divided them into *object-presentative* and *representative* according as they were excited from without and from within. They are determined in direction by the established nerve-paths—the fibres and the connections of cells. (*c.*) The movement takes time; the time occupied is sometimes longer, sometimes shorter, but is always an appreciable period, as will be pointed out later on. (*d.*) It requires a regular supply of properly constituted blood. (*e.*) It is arrested or prevented by an interruption of the continuity of nerve, or by slight modifications of its structure, as by section of or pressure on a nerve, or by compression of the brain. (*f.*) The movements are impeded and finally prevented by the exhaustion produced by frequent or prolonged exercise without due intervals of rest.

So far from discussing whether mind is a function of brain, the business which science now has immediately before it is the more special investigation of the conditions of activity of the ganglionic nerve-cells or groups of nerve-cells and of the fibres which unite them into multitudinous plexuses. If we look to those humbler animals in which nervous tissue makes its first appearance, it is plain that the simple mode of its existence in them allows of no other manner of proceeding; if we trace upwards the gradual increasing complication of the nervous system through the animal kingdom, it is evident that such manner of proceeding is the only one to furnish the materials of a comprehensive and sound induction; and if we duly weigh the results of physiological experiment and pathological research, it is no less certain that we must discard scientific investigation altogether in cerebral physiology, if we reject the ganglionic nerve-cells of the brain as centres of mental force.

In the lowest forms of animal life nerve does not exist: the Protozoa and many of the Zoophytes are, so far as can be ascertained, destitute of any trace of nervous system. The most simple beings consist of an apparently uniform, homogeneous substance, by means of which all their functions are executed.* They are nourished without digestive organs; breathe without respiratory organs; feel and move without organs of sense, without muscles, without nervous system. The stimulus which the little creature receives from without produces some change in the molecular relations of its almost homogeneous substance, and these insensible movements would seem to amount collectively to the sensible movement which it makes. The perception of the stimulus by the creature is the molecular change which ensues, the imperceptible motion passing, by reason of the homogeneity of its substance, with the greatest ease from element to element of the same *kind*, as it were by an infection, or as happens in the sensitive plant; and the sum of the insensible molecular motions, as necessarily determined in direction by the form of the animal, or by some not yet recognised cause, results in the visible movement. The important researches of Graham into the colloidal condition of matter have proved the necessity of considerable modification in the common conception of solid matter: instead of the notion of impenetrable, inert matter, we must substitute the idea of matter which, in its colloidal state, is penetrable, exhibits energy, and is widely susceptible to external agents, "its existence being a continued metastasis."† This sort of energy is not a result of chemical action, for colloids are singularly inert in all ordinary chemical relations, but a result of its unknown intimate molecular constitution; and the undoubted existence of colloidal energy in organic substances which are usually considered inert and called dead, may well warrant the belief of its larger and more essential operation in organic matter in the state of instability of composition in which it is when under the condition of life. Such energy would then suffice to account for the simple uniform movements of the homogeneous substance of which the lowest animal consists; and the absence of any differentiation of structure is a sufficient reason of the absence of any localization of function, and of the general uniform reaction to different impressions. But it will be observed that even the movements of these simplest creatures, in which there is not the least indication of the elements of a nervous system, are not entirely vague, confused, and indefinite; they present certain indications of adaptation to functional ends; they are definite in relation to their medium. They evince, in fact, the fundamental property of living matter, which is manifest even in a mere speck of living protoplasm—namely, adaptive motion in response to impressions, co-ordination of variety to unity of action, a principle of individuation.

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* One must guard against the assumption that any kind of living protoplasm is really homogeneous. Hyaline it may be, but we know not how complex its structure may be. It is possible that sometimes tracks in the apparently homogeneous substance may be so far differentiated as to be adapted to convey impressions, and thus to serve the primitive function of nerve, although we cannot observe the least difference in structure. As nerve is formed by differentiation from apparently homogeneous substance, there must be a period when we cannot say with certainty whether what we see is nerve or is not.

† *Philosophical Transactions*, 1862.

With differentiation of tissue and increasing complexity of organization, which are met with as we ascend in the animal kingdom, the nervous tissue appears, but at first under a very simple form.(¹) Wherever differentiated parts of an organism are combined for a common end, the co-operation is effected by a nervous system. Its simplest type or unit may be represented as two fibres that are connected by a nerve-cell or a ganglionic group of nerve-cells; the fibres are apparently simple conductors, and might be roughly compared to the conducting wires of a telegraph, while the cell, being the centre in which nerve force is generated, may be compared to the telegraphic apparatus; the effect which the stimulus of the afferent or centripetal nerve excites in it is transmitted along the efferent or centrifugal nerve, and therein is displayed the simplest form of that *reflex* action which plays so large a part in animal life.* This type of structure is repeated throughout the complex nervous system of all the higher animals: the fibres with their junction-cells form units from the multiplication and complex arrangement of which the various and most complicated nervous structures are built up. Cut across the afferent nerve or otherwise interrupt its continuity, the impression made upon its terminal fibres cannot reach the centre; cut across the efferent nerve, the central excitation is powerless to influence the muscles or parts to which it is distributed. Not all the passion and eloquence of a Demosthenes could force its way outwards into words, if the motor nerves of the tongue were cut across; he would grimace vainly, like a speechless idiot, if a slight molecular change in their structure sufficient to bar conduction were produced. Owing to the differences of *kinds* of tissue and to the specialization of organs in the more complex animal, there cannot plainly be that intimate molecular sympathy between all parts which there is in the homogeneous substance of the simplest monad; the easy motion, as by an infection, from particle to particle, where the substance is of the same kind, cannot take place in the heterogeneous body, where the elements are of a different kind: accordingly special provision is required for insuring communication between different parts, and for co-ordinating and harmonizing the activity of different organs. The animal must be rendered capable of associating a number of distinct actions for definite ends.

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* *The fibres act as conductors, and have like physiological properties.* Philippeau and Vulpian (*Comptes Rendus*, vi.) and Rosenthal (*Centralblatt*, No. 29, 1864) have succeeded in uniting the central end of the cut lingual nerve, the sensory nerve of the tongue, with the peripheral end of the cut hypoglossal, the motor nerve of the tongue. The natural course of a stimulus is upwards in the lingual, downwards in the hypoglossal. But after the union has taken place, stimulation of the central part of the lingual produced contractions of the tongue, such as normally follow stimulation of the hypoglossal. Thus it is proved that the end of a sensory nerve may be united with the end of a motor nerve, and when the union is complete, excitation of the sensory may be transmitted to the motor fibres. Inversely, stimulation of the peripheral end of the hypoglossal produced evidence of pain. If the end of a rat's tail be grafted into the skin of its back, and when the graft is completed, if the tail be cut through at its base, the animal will, at the end of some months, feel a pinch of the grafted tail and turn round to bite (Bert). The irritation of the nerve which, before the operation, travelled from the end to the base of the tail, *i.e.* centripetally, now travels in the opposite direction, still centripetally. It would seem that, as Mr. Lewes has insisted, the *neurility* is the same in all nerves; the difference of function being due, not to difference of physiological properties, but to differences of connections of the fibres. See also *Leçons sur la Physiologie Générale et Comparée du Système Nerveux*, par A. Vulpian. 1866.

This function, necessitated by the physiological division of labour, the nervous system subserves; and we might compare it to that which the gifted generalizer fulfils in human development: he grasps the results of the various special investigations which a necessary division of labour enforces, brings them together, and elaborates a result in which the different lines of thought are co-ordinated, and a unity of action is marked out for future progress. The nervous system effects the synthesis which the specialization of organic instruments in the analysis of nature renders necessary; it represents the integration of relations, and of relations of relations, of things in a gradually ascending scale; it is the highest expression of that principle of individuation which is the characteristic feature of life in all its forms, but most manifest in its highest forms. To this function it is well adapted, first, by the extent of its distribution, and, secondly, by its exceeding sensibility, whereby an impression made at one part is soon felt at a distance from the place where it is made.

With the increasing complexity of organization which marks the increasing speciality of organic adaptation to external nature, or, in other words, which marks an ascent in the scale of animal life, there is a progressive complication of the nervous system: special developments ministering to special purposes take place. The fibres appear to preserve their characters as simple conductors, while a development of special structures at their peripheral and of special ganglionic cells, or of special connections of cells, at their central endings reveals the increasing speciality and complexity of function. Upon the special terminal structures, which are, as it were the instruments of analysis, depends the kind of the impression made; they are adapted to the special nature of the external impressions which they take up, while the kind of impression that is perceived and the character of the reaction thereto are determined by the nature of the nerve-cells with which the central end of the nerve is connected. Accordingly, we find that with the appearances of the organs of the special senses, as we mount in the scale of animal life, there is a corresponding increase in the ganglionic centres, which, being clustered together, form the primitive rudiments of a brain, and represent, in the main, those sensory ganglia which in man lie at the base of the brain between the decussation of the pyramids and the floors of the lateral ventricles.

It is not known with certainty when the different organs of the special senses severally make their first appearance; they are at first very rudimentary, and are clearly specialized evolutions from the most general sense, that of touch. The skin is an organ of sense which extends over the outside of the body, and perceives by actual contact with the objects that affect it; the other senses are probably nothing else than differentiated involutions of it, complex cuticular structures, which are placed more or less within the body, and they perceive without actual contact; touch then may be justly held to be the primitive, the fundamental sense, that which is the mother tongue of knowledge. In the highest animals the terminal fibres of the nerves of the special senses enter cells which have the character of epithelial cells, and the forms of which are modified according to the nature of the external impressions which they are fitted to receive. This epithelial character of the terminal cells is best seen in the organs of smell and taste, but it is manifest also in the organ of sight; for the so-called staffs and cones of the retina, which are alone sensitive to light, the nerve-cells themselves of the retina and the optic fibres being not, are regarded as metamorphosed epithelial cells.* In some of the lower creatures the organs of hearing, smell, and taste are manifestly special modifications of certain portions of the covering of the body, and the organ of sight itself, when it appears in its earliest and simplest form, is nothing more than the terminal ending of a nerve, surrounded by a few pigment granules, in the epithelial cells of a fold or recess of the skin. Even in the Amphioxus, which is a vertebrate animal, the eyes are two small pigment spots, the organ of smell is a cup-shaped depression at the fore end of the body, and no organ of hearing is discoverable. As we ascend in the scale, structures adapted to the reception of particular impressions, as of light, of sound, of touch, become more special, and render the higher animal capable of more numerous, special, and complex relations with external nature. There is a diffusion through the entire substance of the simplest creatures of physiological properties which are specialized and localized in the higher animals.†

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* Wundt, *Grundzüge der physiologischen Psychologie*, p. 318.

† The Hydra exhibits a sensitiveness to light, although it has no special sense of sight; it shuns the dark and chooses the light side of the vessel in which it is placed. Some again of the zoophytes

Not till we arrive as high as the fishes do we discover anything more in the brain than sensory ganglia connected with the origins of nerves; below them there is no trace of cerebral hemispheres or brain proper. It is plain, then, that the cerebral hemispheres are not essential to sensation or the motor reaction to sensation; for they are altogether wanting where both these functions are displayed in a lively and vigorous way. To the simpler relation between the individual organism and external nature which is denoted by *reflex* or *excito-motor*

that have no definite organs of hearing contract themselves when vibrations of sound are propagated through the medium in which they are. They feel the vibrations, though the feeling is no doubt different in quality from that which a well-developed organ of hearing would impart. "Polypes, zoophytes, and other infusory animalcules that have neither brain nor nerves, feel and move without a nervous system, because the Author of Nature appears to have endowed the pulp of which their bodies are composed with the faculty of sensation and motion, just as the medullary pulp of the nervous system alone, of all the organs of our body, is endowed with that faculty."—PROCHASKA, *On the Nervous System*, p. 387. Syd. Soc. Transl. When a special sense fails in man, the general sensibility may partially replace it. "I have known several instances," says Abercrombie, "of persons affected with that extreme degree of deafness which occurs in the deaf and dumb, who had a peculiar susceptibility to particular kinds of sounds, depending, apparently, on an impression communicated to their organs of touch or simple sensation. They could tell, for instance, the approach of a carriage in the street without seeing it, before it was taken notice of by persons who had the use of all their senses."—*On the Intellectual Powers.* Kruse, who was completely deaf, nevertheless had a bodily feeling of music; and different instruments affected him differently. Musical tones seemed to his perception to have much analogy with colours. The sound of a trumpet was yellow to him; that of a drum, red; that of the organ, green, &c.—*Early History of Mankind*, by J. B. Tylor. In his *Reminiscences of the Opera*, Mr. Lumley tells of a friend who used to compare the voices of the different celebrated singers to different colours, distinguishing them so. It is an old saying of a blind man, that he thought scarlet was like the sound of a trumpet. No doubt colours have different psychical effects, red having an exciting and blue a calming effect.

action, there now succeeds the more complex relation of *sensory stimulus* and *sensori-motor reaction;* in place of general reaction to stimulus, discriminations of impressions and corresponding special reactions by virtue of specially adapted structures are witnessed. This condition or stage of the development of the nervous system, which is natural and permanent in so many of the lower animals, corresponds to that artificial state of things which may be produced experimentally in a higher animal by depriving it of its cerebral hemispheres. The kind of function manifest is strictly comparable to that of the infant's mental life in the early brief stage before the cerebral hemispheres have come into action, or to those phenomena of mental life sometimes displayed by the adult, as for example by the somnambulists, when the influence of the cerebral hemispheres is nearly suspended.

Here is suggested a reflection: how important it is clearly to distinguish in thought and to denote by language special features, which, being included under, or described by, a general term, are so commonly confounded. What different perceptions or reactions, for example, are confounded by the loose way of using the word sensibility! The infusory animalcule, which has no nervous tissue, is said to be sensible of a stimulus; the higher animal, with its special senses, to be sensible of light, or of sound, as the case may be, and, if made to suffer, to be sensible of pain; while it is common enough to speak of man being sensible of pleasure, horror, or disgust, according to the nature of the active ideas. Using the generic term sensibility to express the fundamental reaction, as we may perhaps properly do, it is highly important that we go on further to distinguish by appropriate terms the special differences; the sensibility of pain is not the sensibility of sense, nor is the sensibility of the infusory animalcule equivalent to either of these. So far we have taken pains to distinguish that form of sensibility and reaction proper to the lowest animals, which might be called *irritability;* that form of reaction, or *reflex* action, which is the lowest expression of nervous function; and that form of reaction to which the sensory ganglia minister, which is rightly called *sensorial*.

It is found to be no easy matter to form a distinct conception of the relations of consciousness to these different forms of sensibility. In order to do so, we must at the outset abandon the notion of consciousness as something of constant quality, which either is or is not, and must realise the truth that it may exist in different degrees, ranging from the highest display of self-consciousness through grades of sub-consciousness down to unconsciousness. In the ordinary vague use of the word consciousness, what is implied, though not explicitly asserted, is the reflex consciousness which is properly self-consciousness. There is certainly a vast difference between this highest development of consciousness and that kind which accompanies the sensation of one of the special senses; much more between it and the consciousness, if there be any, which accompanies the sensibility of the infusory animalcule. The latter they place on too high a level who rank it with self-consciousness, as they practically do when they vaguely apply the same word to both: deriving their notion of consciousness from experience of self-consciousness, they apply it to the sensibility of the lowest creatures. It would be hardly less absurd to attribute to them the possession of the complex nervous system which is essential to the manifestation of self-consciousness.

We might say, it is true, that as there are in the tissues of the lowest animals the elements of a nervous system which is in process of time differentiated from them, so in the sensibility which they display there are the elements of those special sensations and of that self-consciousness which appear as their respective organs are individualized in the highest animal; but because we can, by a survey of the course of evolution through the ages, thus foresee in the germ potentially the full fruit, we are not therefore qualified to find the properties of the fruit in the germ: we do wrong to discover in the functions of the lowest organisms the far more specialized functions of the highest organisms, and to translate those into terms of these. Generation is a function which is as widely extended as sensibility through the animal kingdom, but no one dreams of discovering the phenomena which are part of the function of generation in man in the phenomena of generation which the polype displays.

The question is whether we ought to attribute consciousness at all to the sensibility or susceptibility of creatures which have no nervous system. The adapted impression certainly produces a definite effect which issues in a definite movement, either to avoid it, if injurious, or to embrace it, if profitable; but what pretence is there to affirm that consciousness has any part in these events? The phenomena of our own organic life, which are of a much higher order, point the other way; we are not conscious of having a liver, which nevertheless produces marked effects upon our mental moods; we are not conscious of the very powerful influence which it is certain that our sexual organs exert upon our ideas and feelings; we are not conscious of a thousand movements which we make daily, and which nevertheless relieve some uneasy, or occasion some easy, feeling. I know it may be said that we are conscious of these things but do not attend to them; to which I am tempted to reply that it is the attention which is the consciousness, and that a consciousness which is not conscious because it does not attend is not properly called consciousness. I know no reason why those who attribute consciousness to the sensibility of the lowest nerveless creatures should deny it to sulphuric acid when, by virtue of its superior affinity for barium, it goes definitely to work to displace nitric acid from its combination with that base.

It is in fishes that the rudiments of cerebral hemispheres first appear. In them they are represented by a thin layer or projection of nervous matter in front of the optic lobes, covering the corpora striata and the optic thalami; in the Amphibia they have already increased somewhat in size;* in Birds the optic lobes are pushed out to some extent by their further increase; in the Mammalia they begin to cover the optic lobes, and, as we ascend in the scale of life, gradually increase backwards until, in some of the higher monkeys and in man, they entirely cover the cerebellum.

In this ascent through the series of vertebrate animals, it is found that the relations of the sensory ganglia remain alike throughout, the chief differences being differences in the relative size of them. Their functions as primary constituents of the brain may then fairly be reckoned the same in all the vertebrata, and indeed in all the animals in which they exist. As the hemispheres appear as secondary constituents—*secondary*, be it noted, in the order of development, but *primary* in dignity—we may rightly conclude their function to be secondary in the order of development to that which the primary constituents or sensory ganglia fulfil. The impressions received by the sensory centres when these do not react directly outwards, as they may do where hemispheres exist and as they must do where hemispheres do not exist, are in fact passed onwards in the brain to the cells which are spread over the hemispheres, and are there further fashioned into what are called *ideas* or *conceptions*. If the excitation is conveyed to the sensory centre, passes thence to a connected motor centre, and is finally discharged along the motor nerve in motion—if, that is, it passes along what may be called the *sensorial arc*—the function is sensation and sensori-motor action: if, however, the impression is conveyed to the higher ideational centres in the hemisphere, passes thence to motor centres, and is finally discharged along a motor nerve in action—if, that is, it passes along the *ideational arc*—it is perception and volition. Here then we come to another kind of sensibility with its appropriate reaction, to which special nervous centres minister; and it is known as *perception*, or, more strictly, *ideational perception*. As the hemispheres have this function and are not necessary to sensation, it is quite in accordance with what might be predicted, that, as experiments prove, they are insensible to *pain*, and do not give rise to any display of that kind of feeling when they are injured.* They have, agreeably to their special nature, a sensibility of their own to the ideas that are fashioned in them; so that these may be pleasurable or painful or have other particular *emotional* qualities. Emotion is strictly, perhaps, the sensibility of the supreme centres to ideas.

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* The Perenni-branchiate reptiles retain the fish character of brain all their lives; the Batrachians have it only during their tadpole state.

Observation of the mental phenomena of those animals in which cerebral hemispheres exist confirms fully the foregoing view of their function and import. In Fishes there is the first distinct appearance of simple ideas and of the lowest rudiments of emotion; carp will collect to be fed at the sound of a bell, thus giving evidence of the association of two simple ideas; and a shark, suspicious of mischief, will avoid the baited hook. In Birds, conformably to the increased development of the hemispheres, the manifestations of intelligence are much greater; the tricks which some of them may be taught are truly marvellous, and those who teach them know well how much different birds differ in intelligence and temper. We look on such performances as marvellous, because of our ingrained disposition to think surprising all manifestations of intelligence in animals below us in the scale of life; but if we bear in mind the fundamental plastic property of nerve element by which it receives impressions and grows to its modes of exercise, we may abate somewhat our surprise, and see reason to think that animals might be made capable of much higher displays of intelligence if only we took pains to educate them through a few generations. Nor are simple emotional exhibitions wanting amongst birds; very evident at times is the feeling of rivalry or jealousy in canaries, and there are undoubted instances on record in which an orphan bird has owed its life to the kindly care of birds of a different species.* In Mammalia a gradual advance in intelligence may be traced from very humble manifestations up to those highest forms of brute reason which assuredly differ only in degree from the lowest forms of human intelligence.† Consider how deeply meditative the elephant sometimes shows itself; how apt in cunning schemes the monkey is; how plainly in the dog an inhibitory conception often intervenes between the sensation and the usual respondent movement, so that the animal refrains from doing what it has a strong impulse to do, the impression having been passed on to the hemispheres and their controlling action brought into play. It is needless to speak of the various emotions, nay, the veritable moral feeling, displayed by the dog and other domesticated animals. A single reflection will show, what anatomy might lead us to predicate, how limited must be the range of animal intelligence now that its development is checked by the dominating ascendency of man; for how can animal intelligence grow through the ages in face of a superior hostile intelligence which has taken possession of the earth, and is fast subduing all things therein to its uses? If the fox, cunning as it is, had but the sense to learn to climb a tree, like the cat, or always to run to earth, like a rabbit, men would soon give up hunting it. But the fox, like so many men, cannot get out of the accustomed groove of automatic thought, cannot originate anything; and, like not a few intriguing plotters, it wastes a great deal of low cunning in efforts which a little larger view of things would render quite unnecessary.*

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* Those who have made the painful experiment tell us that an animal which makes violent movements while the skin is being cut and the roof of its skull removed, remains quite quiet while its hemispheres are being sliced away bit by bit.

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* *Anatomie Comparée du Système Nerveux*, par Leuret et Gratiolet.

† For examples of remarkable displays of intelligence in different animals, I may refer to a paper by me on the "Genesis of Mind" in the *Journal of Mental Science*, 1862.

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* If the fox did hit upon a discovery of the kind, it would soon be exterminated as vermin and would frustrate the design or final cause of its present existence, which presumably is to serve by its sufferings for human amusement. Some persons have thought that man was the only animal which found pleasure in inflicting torture on other animals merely for amusement, but it would seem that his next-of-kin, the monkey, takes delight in doing so when it gets the chance—that it will catch a crow or pigeon and pluck its feathers off and otherwise torture it, highly gratified with its victim's struggles the while. The cat's play with the mouse might be thought perhaps not to be an original invention, but an accomplishment first taught by man, and now inherited as an instinct, which is still, however, educated in the kitten both by man and by its mother. It may be said truly that man is the only animal which, having imagination enough to realize that its victim suffers, yet delights in inflicting suffering for his sport. Therefore we cannot properly describe fox-hunting as brutal cruelty, or as barbarous cruelty, neither brutes nor barbarians having the imagination to realize the sufferings which they inflict, as civilized persons of this age presumably have; one must call it civilized cruelty, meaning thereby the most sinful cruelty, because a sin against knowledge and right feeling. Thus much from a moral point of view. From a philosophical point of view the

As we ascend through the Mammalian series, we find that not only do the hemispheres increase in size by gradually extending backwards, but that the grey surface of them is further increased by being thrown into folds or convolutions. While the lower Mammals are entirely destitute of such convolutions, these are present, as a rule, in simple forms in the Ruminantia and the higher Carnivora; they are more fully developed in the marine Mammalia, and most fully developed in the apes and in man. It is true that we cannot at present unfold an exact relation between the development of the convolutions and the degree of intelligence in different animals; for the brains of the ass, the sheep, and the ox, which do not evince much intelligence, are more convoluted than those of the beaver, the cat, and the dog, which certainly evince more intelligence. But the relative size of the animals must be taken into account in such comparison. The volume of a body such as the brain which increases in size increases in greater proportion than the superficies, and the latter again in greater proportion than the diameter. Now in each natural group or order of Mammalia, the head, but especially the capacity of the skull, bears a certain proportion to the body, a proportion which remains pretty constant in different species; the head of the tiger or of the lion, for example, has about the same proportion to the body as that of the cat's head to its body, although the sizes of the animals are so different. It follows then that, as the volume of the brain of the tiger in relation to the size of the body is the same as in the cat, and as the larger the brain the smaller the relative

amusement is interesting; for it is a striking instance of the survival in man of a primitive savage instinct, testifying to an animal kinship which he has not yet outgrown. Thus animal nature is avenged in some sort for the oppression which it suffers from human nature; since it declares through man in his pride of place, in accents which cannot be mistaken, that after all he is one with his animal kind.

superficies, the superficies of the brain is proportionately greater in the cat; and that, consequently, in order to get a proportionate extent of grey surface in the tiger, this must be convoluted in it, when it may remain nearly smooth in the smaller animal. If in two animals of equal size, and of like form of structure, the convolutions are differently fashioned, then it may be said truly that one will be more intelligent than the other in proportion as its convolutions are more numerous and complicated and the sulci deeper. Comparing the brains of different species of dogs or of anthropoid apes, it is certain, too, that the more intelligent animals have larger and more convoluted hemispheres.

That proposition is true of man. The intellectual differences which exist between the Bosjesman, or the Negro, and the European are attended with differences in the extent and complication of the nervous substance of the brain. Gratiolet has carefully figured and described the brain of the Hottentot Venus, who was no idiot; and what is at once striking in the figure is the simplicity and regular arrangement of the convolutions of the frontal lobe; they present an almost perfect symmetry in the two hemispheres, "such as is never exhibited in the normal brains of the Caucasian race," and which involuntarily recalls the regularity and symmetry of the cerebral convolutions in the lower animals. The brain of this Bosjeswoman was, in truth, inferior to that of a white woman at the normal stage of development: "it could be compared only with the brain of a white who is idiotic from arrest of cerebral development." Moreover, the differences between it and the brain of the white are unquestionably of the same kind as, though less in degree than, those which exist between the ape's brain and that of man, as Professor Huxley has pointed out.* Mr. Marshall has carefully examined a Bushwoman's brain, and has found like evidence of structural inferiority; the primary convolutions, though all present, were smaller than in the European, and much less complicated; the external connecting convolutions were still more remarkably defective; the secondary sulci and convolutions were everywhere decidedly less developed; there was a deficiency of the system of transverse commissural fibres; and in size, and in every one of the signs of comparative inferiority, "it leaned, as it were, to the higher quadrumanous forms."* The brain of the Negro is superior to that of the Bushman, but still it does not reach the level of the white man's brain; the weight of the male Negro's brain is less than that of the average European female; and the greater symmetry of its convolutions, and the narrowness of the hemispheres in front, are points in which it resembles the brain of the orang-outang, as even Tiedemann, the Negro's advocate, has admitted.

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* *Man's Place in Nature.*

Among Europeans it is found that, other circumstances being alike, the size of the brain bears a general relation to the mental power of the individual, although apparent exceptions to the rule sometimes occur. The average weight of the brain in the educated class is certainly greater than in the uneducated; and some carefully-compiled tables in a valuable paper by Dr. Thurnam prove that, while the *average* brain weight of ordinary Europeans is 49 oz., in distinguished men it is 54·6 oz.† On the other hand, the brain is oftentimes very small in idiots; the parts being not only smaller, but less complex, and the convolutions in particular being simpler and less developed. Mr. Marshall found the convolutions of the cerebra of the two idiots which he examined to be fewer in number than in the apes, the brains being in this respect more simple than the brain of the gibbon, and approaching that of the baboon. In fact, there are microcephalic idiots which present a complete series of stages in a gradual descent from man to the apes. As a general proposition, it is certainly true that we find the evidence of a correspondence between the development of the cerebral hemispheres and of the intelligence, when we examine the different races or kinds of men, as we do when we survey the scale of animal life. But in making comparisons between the brains of men in the same state of civilization we must not lose sight of the fact that quality has to be taken into account as well as quantity. An increase in the rapidity of undulations of vibrating ether makes *that* light which before was darkness; and it is conceivable that, in like manner, an increase in the number of vibrations in the nerve-tracts of the brain might convert stupidity into genius. A demented patient, whose mind seemed nearly extinguished, has in some instances recovered temporary intelligence in a marvellous manner during the excitement of a fever; and persons who have not been remarkable for mental display will sometimes exhibit surprising intellectual sparks at the commencement of an attack of acute mania. It stands to reason that the susceptibilities of nerve element to molecular vibrations should be determined by that intimate condition of its nature which the word *quality* denotes, and should be affected afterwards by slight physical modifications of its condition.

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* *Philosophical Transactions*, 1865.

† *On the Weight of the Human Brain*, by John Thurnam, M.D.; *Journal of Mental Science*, April 1866. Professor Wagner has carefully figured and described the brains of five very distinguished men. The extremely complex arrangement of the convolutions was most remarkable.—*The Convolutions of the Human Cerebrum*, by W. Turner, M.B. 1866.

As in the series of the manifold productions of her creative art Nature has made no violent leap, but has passed by gentle gradations from one species of animal to another, and from the highest animal to the lowest man, it is not surprising that the embryonic development of man should present indications of the general plan.* It admits of no question that man does, in the course of his development, pass through stages closely resembling those through which other vertebrate animals pass, and that these transitory conditions in him are not unlike the forms that are permanent in the lower animals; he presents us in the microcosm with an abstract of the evolution which has gone on through countless ages in the macrocosm. There is a very close morphological resemblance between the human ovum and the lowest animals with which we are acquainted, the microscopic Gregarinida;† in both, an outer membrane contains a soft semi-fluid substance, at one end of which is a delicate vesicle having in it a solid particle or spot. At the earliest stages of its development no human power can distinguish the human ovum from that of a quadruped; scrutinize it as carefully as you will with the highest microscopical powers, you shall not be able to say whether it contains the potentialities of a Socrates or of a he-goat; and, as it proceeds to its destined end, it passes through similar stages to those through which other vertebrate embryos pass.

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* "That there should be more species of intelligent beings above us," says Locke, "than there are of visible or material below us, is probable to me from hence, that in all the corporeal world we see no chasms or gaps." But how can it be safe to apply to the unseen a generalization from the seen? Between the corporeal and spiritual world there is, at any rate, a vast chasm or gap.

† "The Gregarinida," says Huxley, "are all microscopic, and any one of them, leaving minor modifications aside, may be said to consist of a sac, composed of a more or less structureless, not very well defined membrane, containing a soft semi-fluid substance, in the midst, or at one end, of which lies a delicate vesicle; in the centre of the latter is a more solid particle. No doubt many persons will be struck with the close resemblance of the structure of this body to that which is possessed by an ovum. You might take the more solid particle to be the representative of the germinal spot, and the vesicle to be that of the germinal vesicle; while the semi-fluid sarcodic contents might be regarded as the yelk, and the outer membrane as the vitelline membrane. I do not wish to strain the analogy too far, but it is at any rate interesting to observe this close morphological resemblance between one of the lowest of animals and that form in which all the higher animals commence their existence." —*Lect. on Comp. Anat.* 1864.

That which is true of the whole body is true also of the development of the brain. The brain of the human fœtus at the sixth week may be described in general terms as consisting of a series of vesicles, the foremost of which, a double one, representing the cerebrum, is the smallest, and the hindmost, representing the cerebellum, the largest. In front of the latter is the vesicle of the corpora quadrigemina; and in front again of this, the vesicle of the third ventricle, which contains also the thalami optici, and which, as development proceeds, becomes covered, as do the corpora quadrigemina, by the backward growth of the hemispheres in front of it. At this stage the human brain resembles the fully-formed brain of the fish, more closely the brain of the fœtal fish, in the small proportion which the cerebral hemispheres bear to the other parts, in the absence of convolutions, in the deficiency of commissures, and in the general simplicity of structure. Later, about the twelfth week of embryonic life, there is a great resemblance to the brain of the bird: the cerebral hemispheres are much increased in size, and arch back towards the thalami optici and the corpora quadrigemina, though there are still no convolutions and the commissures are very deficient. Up to this time the cerebral hemispheres represent no more than the rudiments of the anterior lobes; they do not yet completely cover the thalami optici, nor indeed pass the grade of development which is permanent in the Marsupial Mammalia. During the fourth and early part of the fifth months, the middle lobes develop backwards and cover the corpora quadrigemina; and, subsequently, the posterior lobes sprout out, so to speak, and gradually extend backwards so as to cover and overlap the cerebellum. It was upon the erroneous assumption that the posterior lobes were peculiar to man, that Professor Owen grounded his division of the *Archencephala;* but it has now been proved beyond doubt that the posterior lobes exist in the apes, and that in some apes they extend as far back as they do in man. It is easy to perceive, then, that an arrest of development of the human brain at one stage or another of its formation may leave it very much in the condition of an animal brain; and it is found in some cases, as a matter of fact, that congenital idiots have brains very like those of the monkeys.

As man is thus a sort of compendium of animal nature, paralleling nature, as Sir Thomas Browne has it, in the cosmography of himself, we find exhibited in the workings of his organism all the different modes or kinds of nervous function which are met with in the animal kingdom. The so-called irritability of tissue, whereby it reacts to a stimulus without the help of nerve, may be of the same kind as that molecular energy of matter manifest in the movements of the humblest animal: whether the nerve ends outside the sarcolemma of muscle, or within it, there can be no doubt that it is not distributed to every particle of the sarcous element; and, at any rate, when all nervous influence is withdrawn, an energy still exists sufficient to produce rigor mortis of the muscle.*

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* It has furthermore been maintained by Bilharz and Kühne that the nerves pass by continuity into the muscular substance, as in the electric organs of the fishes they pass continuously into the protoplasm of the electric plates. The controversy respecting the manner in which nerves end in muscles seems, then, likely to terminate in the conclusion that they do not end at all, but pass by continuity of substance into the sarcous elements. The observations of Kühne and Rouget prove that the nerve fibre, reduced to its axis cylinder, penetrates the sarcolemma, and is lost. The nervous filaments of insects cannot sometimes be distinguished from the other elements

The simplest mode of nervous action in man, comparable to that of the lowest animals that possess nerve, is exhibited by the scattered ganglionic cells belonging to the sympathetic system which are concerned in certain organic processes. The heart's action, for example, is due to the ganglionic cells dispersed through its substance; Meissner has shown that nerve-cells disseminated through the tissues of the intestines govern their motions; and Lister thinks it probable that cells scattered in the tissues preside over the contractions of the arteries, and over the remarkable diffusion of the pigment granules which takes place in the stellate cells of the frog's skin. The separate elements of the tissue are co-ordinated by the ganglionic nerve-cells of the sympathetic system; and these co-ordinating centres, again, are found to be under the control of the cerebro-spinal centres. In the spinal cord the ganglionic nerve-cells are collected together, and so united that groups of them and connected groups of them become independent centres of combined movements, simultaneous and successive, in answer to stimuli; this arrangement representing the entire nervous system of those animals in which no organs of special sense have yet appeared. The stimulus conveyed by the afferent nerve does not go directly across the cord and produce the first movement at hand, but excites the energies of a plexus of interconnected cells, which energies are expressed ultimately in the efferent or motor effect; not otherwise than, as we shall see hereafter, a stimulus to the brain excites energies in the plexuses of its convolutions which appear in consciousness as reflection and issue finally in voluntary movement.

Still higher in the scale of the nervous system, the sen-

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by means of the microscope. Pflüger has discovered that the nerves to the glands penetrate the walls of the cells, and, as he believes, end in the nuclei.

sory ganglia, consisting of multitudes of cells differentiated by their special connections, are clustered together, forming a very important part of the brain of man, while in many animals, as already seen, they constitute the whole of the brain. In the cerebral hemispheres there is still greater specialization and complication of structure with corresponding exaltation of function; and, conformably to its highest degree in man, there are in him the highest and the most complex manifestations of mental function. In the human organism, then, is summed up the animal kingdom, which actually presents us with a sort of analysis of it; for in the functions of man we observe, as in a microcosm, an integration and harmonious co-ordination of different vital actions which are separately displayed by subordinate members of the animal kingdom.

In dealing with the function of the nervous system in man, it is, then, most necessary to distinguish different nervous centres:—

1. The *primary* centres, or *ideational* centres, constituted by the grey matter of the convolutions of the hemispheres. They are superordinate to

2. The *secondary* nervous centres, or *sensory* centres, constituted by the collections of grey matter that lie between the decussation of the pyramids and the floors of the lateral ventricles. These are subordinate to the primary and superordinate to

3. The *tertiary* nervous centres, or centres of *reflex* action, constituted mainly by the grey matter of the spinal cord; which again are superordinate to

4. The *organic* nervous centres, as we might call them, belonging to the sympathetic system. They consist of a set of ganglionic bodies distributed mainly over the viscera, and connected with one another and with the spinal centres by internuntiant cords.

Each distinct centre is subordinated to the centre immediately above it, but is at the same time capable of determining and maintaining certain movements of its own without the intervention of its supreme centre. For example, the rhythmical contractions of the heart are kept up by the ganglia distributed through its substance, and accordingly continue for a time after the removal of the organ from the body. But these local powers are not left uncontrolled: terminal branches of the vagus nerve, or rather branches of a motor nerve called the spinal accessory, which go with the vagus to the heart, are connected in some way with the ganglia; and when the vagus is irritated the ganglia are controlled and cease to act upon the heart, which comes to a standstill in a relaxed condition. The organization of the entire nervous system is such that a due independent local action is compatible with the proper control of a superior central authority. The ganglionic cells of the sympathetic co-ordinate the energy of the separate elements of the tissue in which they are placed, and thus represent the simplest form of a principle of *individuation;*[*] through the cells of the spinal centre the functions of the different organic centres are so co-ordinated as to have their subordinate but essential place in the movements of animal life—and herein is witnessed a further and higher individuation; the spinal centres are similarly controlled by the sensory centres; and these, in their turn, are subordinate to the controlling action of the cerebral hemispheres, and especially to the action which, revealing itself in consciousness as will, represents the most complete co-ordination of the functions of the hemispheres, and is the highest display of the principle of *individuation.* The more unlike the parts in any animal and the more complex their subordination, the higher and the more perfect it is.* Were it not well if man in his social life could contrive to imitate this excellent organization?

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[*] Coleridge, in his *Hints towards the Formation of a Comprehensive Theory of Life,*" takes from Schelling the definition—"Life is the principle of Individuation."

Most important and varied functions having been ascribed to nerve-cells, it may be asked: on what evidence do the statements rest? On the evidence of anatomical investigation, experiments upon animals, and physiological and pathological researches.

(*a*) *Anatomical Evidence.*—It is certainly not possible to trace every nerve fibre to its connection with a cell, and until lately no such connection had been distinctly seen; but it has now been observed in many instances, and most investigators believe that neither in the brain nor in the spinal cord does there exist an isolated apolar nerve-cell; such, if supposed to be seen, being in reality one which has had its processes torn away, or a young one that has not yet formed its connections, or not being a nerve-cell at all, but a connective tissue corpuscle. This is an inference which has scarcely less certainty than an observed fact; as Goethe has said, it is not necessary to travel round the world in order to feel sure that the heaven above is everywhere blue.†

Granting the constant connection of the fibre with the cell, are the ganglionic cells so numerous and so arranged as to render it conceivable that they can minister adequately to the manifold and complex manifestations of our mental life? Most certainly they are: Dr. Lockhart

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* After speaking of an organism as a collection of individual elements, Goethe goes on to say:—"Je unvolkommener das Geschöpf ist desto mehr sind diese Theile einander gleich oder ähnlich, und desto mehr gleichen sie dem Ganzen. Je volkommener das Geschöpf wird, desto unähnlicher werden die Theile einander. Je ähnlicher die Theile einander sind, desto weniger sind sie einander subordinirt. Die Subordination der Theile deutet auf ein volkommeneres Geschöpf."

† Um zu begreifen das der Himmel überall blau ist, braucht man nicht um die Welt zu reisen.

Clarke's careful and valuable researches into the structure of the cortical layers of the hemispheres reveal a variety, delicacy, and complexity of constitution such as answer to the varied and complex manifestations of mind. The following concise summary of those important researches, for which I am indebted to Dr. Lockhart Clarke's kindness, will indicate exactly how the complexity of physical structure agrees with the complexity of mental function :—

"In the human brain most of the convolutions, when properly examined, may be seen to consist of at least *seven* distinct and concentric layers of nervous substance, which are alternately paler and darker from the circumference to the centre. The laminated structure is most strongly marked at the extremity of the *posterior* lobe. In this situation all the nerve-cells are *small*, but differ considerably in shape, and are much more abundant in some layers than in others. In the superficial layer, which is pale, they are round, oval, fusiform, and angular, but not numerous. The second and darker layer is densely crowded with cells of a similar kind, in company with others that are *pyriform* and *pyramidal*, and lie with their tapering ends either toward the surface or parallel with it, in connection with fibres which run in corresponding directions. The *broader* ends of the pyramidal cells give off two, three, four, or more processes, which run partly towards the central white axis of the convolution and in part horizontally along the plane of the layer, to be continuous, like those at the opposite ends of the cells, with nerve fibres running in different directions.

"The third layer is of a much paler colour. It is crossed, however, at right angles by narrow and elongated groups of small cells and nuclei of the same general appearance as those of the preceding layer. These groups are separated from each other by bundles of fibres radiating towards the surface from the central white axis of the convolution, and together with them form a beautiful fan-like structure.

"The fourth layer also contains elongated groups of small cells and nuclei, radiating at right angles to its plane; but the groups are broader, more regular, and, together with the bundles of fibres between them, present a more distinctly fan-like arrangement.

"The fifth layer is again paler and somewhat white. It contains, however, cells and nuclei which have a general resemblance to those of the preceding layers, but they exhibit only a faintly radiating arrangement.

"The sixth and most internal layer is reddish-grey. It not only abounds with cells like those already described, but contains others that are *rather larger*. It is only here and there that the cells are collected into elongated groups which give the appearance of radiations. On its under side it gradually blends with the central white axis of the convolution, into which its cells are scattered for some distance.

"The seventh layer is this central white stem or axis of the convolution. On every side it gives off bundles of fibres, which diverge in all directions, and in a fan-like manner, towards the surface through the several *grey* layers. As they pass between the elongated and radiating groups of cells in the *inner* grey layers, some of them become continuous with the processes of the cells in the same section or plane, but others bend round and run *horizontally*, both in a transverse and longitudinal direction (in reference to the course of the entire convolution), and with various degrees of obliquity. While the *bundles* themselves are by this means reduced in size, their component *fibres* become finer in proportion as they traverse the layers towards the surface, in consequence, *apparently*, of branches which they give off to be connected with cells in their course. Those which reach the outer grey layer are reduced to the finest dimensions, and form a close network with which the nuclei and cells are in connection.

"Besides these fibres, which *diverge* from the central white axis of the convolution, another set, springing from the same source, converge, or rather curve inwards from opposite sides, to form arches along some of the grey layers. These arciform fibres run in differen planes—transversely, obliquely, and longitudinally—and appear to be partly continuous with those of the *divergent* set which bend round, as already stated, to follow a similar course. All these fibres establish an infinite number of communications in every direction between different parts of each convolution, between different convolutions, and between these and the central white substance.

"The other convolutions of the cerebral hemispheres differ from those at the *extremities of the posterior lobes*, not only by the comparative faintness of their several layers, but also by the appearance of some of their cells. We have already seen that, at the extremity of the *posterior* lobe, the cells of ALL the layers are *small* and of nearly uniform size, the inner layer only containing some that are a little larger. But, on proceeding forward from this point, the convolutions are found to contain a number of cells of a *much larger kind*. A section, for instance, taken from a convolution at the vertex, contains a number of *large*, triangular, oval, and pyramidal cells, scattered at various intervals through the two inner bands of arciform fibres and the grey layer between them, in company with a multitude of smaller cells which differ but little from those at the extremity of the posterior lobe. The pyramidal cells are very peculiar. Their bases are quadrangular, directed towards the central white substance, and each gives off four or more processes which run partly towards the centre to be continuous with fibres radiating from the central white axis, and partly parallel with the surface of the convolution to be continuous with *arciform* fibres. The processes frequently subdivide into minute branches, which form part of the network between them. The opposite end of the cell tapers gradually into a straight process, which runs directly towards the surface of the convolution, and may be traced to a surprising distance, giving off minute branches in its course, and becoming lost, like the others, in the surrounding network. Many of these cells, as wells as others of a triangular, oval, and pyriform shape, are as large as those in the anterior grey substance of the spinal cord.

"In other convolutions the vesicular structure is again somewhat modified. Thus, in the surface convolution of the great longitudinal fissure, on a level with the *anterior* extremity of the corpus callosum, and therefore corresponding to what is called the superior frontal convolution, all the three inner layers of grey substance are *thronged* with pyramidal, triangular, and oval cells of considerable size and in much greater number than in the situation last mentioned. Between these, as usual, is a multitude of nuclei and smaller cells. The inner orbital convolution, situated on the outer side of the olfactory bulb, contains a vast multitude of pyriform, pyramidal, and triangular cells, arranged in very regular order, but none that are so large as many of those found in the convolutions at the vertex. Again, in the *insula*, or island of Reil, which overlies the extra-ventricular portion of the corpus striatum, a great number of the cells are somewhat larger, and the general aspect of the tissue is rather different. A further variety is presented by the *temporo-sphenoidal* lobe, which covers the *insula* and is continuous with it; for while in the superficial and deep layers the cells are rather small, the middle layer is crowded with pyramidal and oval cells of considerable and rather uniform size. But not only in different convolutions does the structure assume, to a greater or less extent, a variety of modifications, but even different parts of the same convolution may vary with regard either to the arrangement or the relative size of their cells.

"Between the cells of the convolutions in man and those of the *ape tribe* I could not perceive any difference whatever; but they certainly differ in some respects from those of the larger Mammalia—from those, for instance, of the ox, sheep, or cat."*

Dr. Herbert Major has recently made a careful examination of the minute structure of the convolutions of the brain of the Chacma Baboon, and he finds that the general characters thereof agree with those that are met with in the human brain—that the forms and relations of the cells show no variation. There was only one doubtful exception to this general rule, and that was the *second layer* of the frontal and parietal convolutions, the large cells of which are more rare in the baboon than in man. Whether such predominance of large cells in man is connected with superior function in him, must of course be entirely conjectural. Dr. Major was, however, led by a close comparison of numerous sections of brain to the distinct conclusion that in man the number of the cell processes, and, as a consequence, the extent of their connections, are greater than in the baboon; and he believes that the more numerous and complex anastomoses have relation to the superior functional activity in man.*

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* In the first edition of this work an error occurred in the brief abstract made of Dr. Clarke's investigations, as they appeared in the *Proceedings of the Royal Society*, vol. xii. 1863. I regret the mistake the less, as it has been the occasion of my receiving, from Dr. Clarke's own pen, the above clear and concise description of his latest researches.

Schroeder van der Kolk found a different structure of the grey substance of the convolutions in the anterior and posterior lobes of the dog and the rabbit: in the anterior lobes of the rabbit there are bundles of fibres, with cells, mostly tripolar, between them; in the posterior lobes there is a regular series of pedunculated cells, which are placed close to one another, like organ pipes; there are also single larger cells. As the result of his investigations, continued through an industrious lifetime, he states positively that, wherever there are differences of function, there differences of structure and composition and connexion do exist; "microscopical investigation has established this in the completest manner."—*Die Pathologie und Therapie der Geisteskrankheiten auf Anatomisch-Physiologischer Grundlage.* Von J. L. C. Schroeder van der Kolk. 1863.

Assuredly we are lost in the vastly intricate and complicated mechanism of cerebral cells and fibres when we attempt to trace the way in which function goes on, but we may perhaps realise how sufficient or more than sufficient for all the variety of our mental processes is the multitude of cells and extremely delicate fibres which constitute the convolutions. It is certain that in one cubic inch of convolution there would be found, if they could be counted, several hundred thousand nerve-cells and fibres, and in all the convolutions cells more in number than the stars of heaven; and when we compare these numbers with the number of words made use of by the most fertile writers, we shall perhaps be tempted to think that only a small portion of our intellectual instruments are actually utilized.† Out of a possible number of English words amounting to ninety or a hundred thousand, Shakespeare uses about fifteen thousand, Milton about eight thousand, and an agricultural labourer about three hundred.

Complex, however, as is the structure of the convolutions, we find the same type as in the spinal cord—namely, the nerve-cell forming the junction of fibres and of other cells; this structure being multiplied in the brain in innumerable plexuses. Moreover, we find suitable anatomical provision for uniting in common function different parts of the same convolution, different convolutions of the same hemisphere, and corresponding convolutions of the two hemispheres. Besides the fibres which are a continuation of the central white axis, and which conduct to and from the grey matter, there are the commissural fibres connecting corresponding parts of the two hemispheres and effecting simultaneous or successive function of these parts; and there are also the arciform fibres passing between different parts of the same hemisphere and combining in function both adjacent and more distant convolutions. Anatomy clearly reveals a structure destined to subserve varied and intimate intercommunion of function. And we may conceive, as we survey these manifold uniting fibres and the innumerable multitude of junction-making cells, how it happens that the functions of the cortical layers are soon restored after a partial destruction thereof; in the grey matter of these layers, as in the grey matter of the spinal cord, it is probable that equivalent parts connected in the most intimate and complex way may take the place of each other functionally. We may conceive, also, how it is that with two distinct hemispheres we have not a divided but a single consciousness; one hemisphere is so intimately united by commissural fibres with the other that they are bound together in function and their consciousness is made one; were the cortical centres of the brains of two men as closely united by commissural fibres as are the two hemispheres of one brain, they perhaps would not have a double but a single consciousness. The phenomena of hemiplegia prove that when two corresponding motor centres, which have to do with opposite parts of the body, lie near together and are closely united anatomically, and have been accustomed to act together functionally, their functions are coincident, and one will do the work of the other when the latter is damaged.

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* "Observations on the Brain of the Chacma Baboon."—*Journal of Mental Science*, January, 1876.

† "A portion of grey matter upon the surface of a convolution, not larger than the head of a very small pin, will contain portions of many thousands of nerve-fibres, the distal ramifications of which may be in very distant and different parts of the body."—*Bioplasm*, p. 321. Dr. Beale, 2nd Ed.

Although there are observable differences in the size and configuration of the cells of the cortical layers, as of the cells of other centres, yet it is clear that we cannot at present penetrate those intimate special differences in constitution or composition, or trace those special connections, which the variety of their functions implies. These essential differences of constitution are not such, indeed, as the microscope is ever likely to reveal; for they probably depend on the intimate chemical composition, and are not likely, even if we could isolate cells as required, to be disclosed until chemistry has arrived at microscopical application, or until some means has been discovered of penetrating the molecular constitution of nerve element. Those who may be disposed to think it impossible that such important constitutional differences should exist in so small a compass, might reflect with advantage on the various undetectable conditions which may confessedly exist in the minutest organic matter; as, for example, in the delicate microscopic spermatozoon, or in the intangible virus of a fever. And yet it is from the conjunction of a minute spermatozoon with a minute germinal vesicle that are produced the muscles, vessels, nerves, and brain—the intellectual organs of a Socrates or a Cæsar. The single sperm-cell, integrating the qualities of generations of male and female ancestors, unites with the germ-cell, integrating in like manner the qualities of generations of male and female ancestors, and gives birth to a new organic product which, minute as it is, contains in latent form all the potentialities, and displays actually in evolution many of the qualities, of ancestors on both sides, and furthermore evinces new qualities as a result of the organic combination; not otherwise than as a chemical compound evinces properties that are unlike those of its constituents. There is nothing extravagant in the supposition that a single nerve-cell may contain like potentialties.* Consider, again, the infinite littleness of the odorous particles that affect the smell, and, more wonderful still, the marvellous discriminating susceptibility of sense to these undetected agents. The exquisite minuteness and consummate delicacy of the operations going on in the most intimate recesses of nature are even more striking and wonderful than the vastness and grandeur with which the astronomer is concerned. "What the immensity is to the astronomer or geologist," says Sir H. Holland, "such are these infinitely small dimensions of matter in space to the physiologist." Of what may happen in a world into which human senses have not yet found means of entering we are no better entitled to speak than the blind man is to talk of the appearance of objects. In such matter it would be more wise to adopt Tertullian's maxim, "Credo quia impossible est," than that which is so much favoured by the conceit of human ignorance—that a thing is impossible because it appears to be inconceivable.†

(*b*) *Experiments on Animals* have distinctly proved the differences between the functions of the ganglionic cells that constitute the principal different nervous centres; but such results will more properly find their place afterwards. Let it suffice here to say that the sight of an animal may be destroyed by injury to its corpora quadrigemina as surely as by burning out its eyes. By the experiments of Fritsch and Hitzig, which have been repeated and extended by Dr. Ferrier, something has lately been done towards distinguishing the functions of different convolutions.

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* It is worth remark that similar complex chemical compounds have been found in nerve-substance and in the semen and the ovum, calling to mind the statement of Alcmæon, an ancient writer on medical subjects, that a drop of semen is a drop of brain.

† The latest speculations concerning the actual constitution of atoms render it probable that even chemical atoms are really very complicated structures, and that in them there are complex intestine motions of which we have not the least conception. "An atom of pure iron is probably a vastly more complicated system than that of the planets and their satellites."—JEVONS, *Principles of Science.* The smallest particle of solid matter will consist of a number of such systems united in regular order, the problem of their forces and motions being beyond the reach of our mathematical powers, even were the systems accessible to observation.

(*c*) *Physiological Evidence.*—The study of the plan of development of the nervous system through the animal kingdom, with the corresponding progress in complexity of function, undoubtedly furnishes the best testimony in favour of differences in the constitution and function of the nerve centres. That evidence has already been sufficiently set forth.

The hopeless vanity of all discussions concerning infinite or absolute truth might well have been made manifest by this physiological reflection: that our perception of external nature is the *effect* which the object produces, through an adapted medium, in certain of our central nerve-cells, an effect on which we can exercise no influence; it is, as Hobbes puts it, "but an apparition unto us of the motion, agitation, or alteration, which the object worketh in the brain, or spirits, or some internal substance of the head." Excite that condition of the central cell otherwise than by the stimulus from without, the perception does not fail to ensue: a blow on the eye produces flashes of light; on closing the eyes after looking at the sun a spectrum of it remains, which, as it slowly fades away, may be brightened and darkened alternately for a time by pressing the eye and removing the pressure; luminous spectra are sometimes seen after complete destruction of the retina; a disturbance of the circulation in the auditory ganglia gives rise to noises in the ears; an insane person who is quite deaf will sometimes hear what he believes to be the voices of persons addressing him, and will dispute with them; in fact, all the senses may be excited subjectively. The reason is evident: because the perception depends upon the nature of the special centres and the mechanism by which the stimulus is conveyed to them. The idea in the mind is the result of an action excited in the nerve centres; the external impression not being conveyed to them, but exciting the physiological property of the nerve, which thereupon gives rise in them to the special effect. Accordingly, the effect of any stimulus capable of affecting one of the special senses is, as Müller pointed out, of the same kind as that produced by the proper stimulus of the particular sense: thus the effect of the electric stimulus on the optic ganglia is to cause a sensation of light; on the olfactory nerves, some kind of smell; on the gustatory nerves, some kind of taste. In like manner, whether irritation of a nerve shall produce a muscular movement, a secretion, or a sensation, depends not upon the constitution of the nerve, nor upon the means of irritation, but upon its connections—whether it is connected with a muscle, gland, or sensory centre. It is clear then that the qualities of our sensations do not represent corresponding qualities in objects—that our senses do not give us anything like an exact impression of the outer world. Whether the rays of the sun appear to us as colour or heat depends not upon any properties of colour or heat in them, but simply upon the fact whether they stimulate the fibres of the optic nerve or those of the skin; and of what colour rays of light shall appear to us will depend entirely upon the length of the undulations, those of red being the longest, those of violet the shortest. If the nerve fibres which answer to the undulations of what appears in us as red were wanting in our eyes, we should not have the least conception of red.* That man is by nature thus limited to the reception of certain special impressions through a few avenues, proves how limited must be his knowledge at the best: it may well be, of a truth is, that there are many things in nature of which he has not, and cannot have, the least apprehension; and that a new sense conferred upon him might alter the whole aspect of the universe and transform entirely the character of that which he calls knowledge.

What is true of the sensory ganglia is probably no less true of the higher centres of intelligence. There is reason to assume differences, not merely between ganglionic centres in one lobe of the brain and in another, but also between centres in the same lobe and even in the same convolution. The law of progress from the general to the special in organic development does not, it may be presumed, stay its action suddenly at the cerebral hemispheres. The philosopher is not, it is true, in possession of more senses than the savage; but he unquestionably has more numerous and complex convolutions, and, therefore, many more differentiated centres in the primary centres of intelligence. The differences between persons notably become greater as civilization increases; and outer differences assuredly mean differences in the innermost. It is a common remark that all savages are much alike, and it is certain that uneducated labourers are more like one another than educated persons are. By intending his mind to the realities of external nature the scientific inquirer acquires information through the senses, but his intelligence reacts advantageously upon the senses; he constructs instruments which extend their power of observation,—thus acquires, as it were, new artificial senses; so that hitherto obscure relations of external nature are disclosed to him, and he attains to more special and complex relations therewith. If in the nervous centres cortical cells of a higher quality and of more complicated connections than the savage has, do not answer to this increased speciality and complexity of external relations, it is contrary to all the analogy of organic development.

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* Suppose that men and all animals that have similar organs of sight were swept off from the face of the earth: there would be no light, for light is something relative to the eye; without which it could have no existence as such. And if the earth were inhabited by beings so differently constituted as to have entirely different kinds of senses from what we have, it is impossible to conceive what the world would be to them. We find ourselves in a position in which we are acted upon and react, and, being conscious of this action and reaction, we get the notions of *object* and *subject;* we are constrained to believe in an external something, not ourselves, which is beneath the phenomena of which we are conscious, and which includes us in its operations, and we may represent it as we will as nature, or a universally immanent spirit, or as personal God, or personal devil. But we never can know more of this external something which is not ourselves than in its relation to ourselves—can never by any possibility know what it is in itself. Men should amuse themselves by trying to develop a new sense in some individual or in his progeny by selective breeding, as the bees, having lost their queen, take in hand a common young one, and feed and foster it into a queen bee. He might amply repay their pains by teaching them how little they really knew of the external something which is not themselves.

(*d*) *Pathological Evidence.*—This will be brought forward in detail at a later period. Let it suffice here to say, that Schroeder van der Kolk could venture to assert that he never failed to discover morbid changes of structure in insanity, and that, when intellectual disorder especially had existed, he had found the cortical layers under the frontal bones to be darker coloured, more firmly connected with the pia mater, or softened; in melancholia, on the other hand, where the feelings mainly were excited or depressed, the pathological changes were found principally in the convolutions of the upper and hind lobes. In old age when the memory fails, he found the cells of the cortical layers visibly atrophied. The very many and various disorders to which the memory is liable, failures of such variety, degree and character as can only be described by being given in detail, surely indicate in no uncertain way the different functions of different centres in the cortical layers of the hemispheres.

Thus much, then, by way of setting forth facts which will not easily be discredited. What is the unavoidable conclusion? That no true scientific result can possibly proceed from a vague and general descriptive employment, without further discrimination, of mental action to embrace phenomena of such manifestly different nature. If the psychologists had duly minded the old but wholesome maxim, that whosoever distinguishes well teaches well, they might have found in the revelations of self-consciousness, when interpreted without bias, those distinctions which an investigation of the physiology of the nervous system in man and animals establishes beyond question. But the metaphysical conception of mind, the abstraction made into an entity, has overridden all discerning observation, and, confounding well-marked differences in a vague obscurity, has constructed a loose system of undefined words in place of an exact and positive science of facts. Instead of mind being, as assumed, a wondrous spiritual entity, the independent source of power and self-sufficient cause of causes, an honest observation proves incontestably that it is the most dependent of all the natural forces. It is the highest development of force, and to its existence all the lower natural forces are indispensably prerequisite.

It is most needful, if we would avoid confusion and error, once for all to form a just and definite conception of what we intend to mean by mental force, and of its position in nature. The various definitions of mind which philosophers have tendered do not help us far on our way. It is the *substantia cogitans*, says Descartes; "that which thinks, reasons, wills," says Reid; "the subject of the various internal phenomena of which we are conscious, or the subject of which consciousness is the general phenomenon—that which perceives, thinks, feels, wills, desires," says Sir W. Hamilton; "the sum total of subject experiences, that which has not extension," according to Mr. Bain. But what is the thinking substance: that which thinks, reasons, wills; that of which consciousness is the phenomenon; that which is the subject of experiences; when we resolutely pierce the vague abstraction and get as near as we can to the concrete fact? The physiologist answers that it is the brain, not any supposititious metaphysical entity of the existence of which he has no evidence whatever, and of the need of which as a hypothesis he is not conscious. To him the hypothesis is as superfluous in thought as it is unfounded in observation. By observation of mental phenomena wherever displayed and of whatever sort, by experiment, by reasoning—by all the means of knowing which serve him in other scientific inquiries, he has come to the assured conviction that mind does not exist in nature apart from brain: all his experience of it is in connection with brain just as all his experience of gravitation is in connection with matter: he has never met with gravitation without a heavy body, chemical force without chemical substances, life without organic matter, thought without nervous tissue. Mind he holds to be nothing more than a general term denoting the sense of those functions of brain which are accompanied by consciousness, and which are commonly described as thought, feeling, and will. (3) To deal with mind as a force in nature apart from the consideration of the matter through the changes of which it is manifested, is truly no less vain and absurd than it would confessedly be to attempt to handle electricity and gravitation as forces apart from the changes in matter by which alone we know them. No man in his senses would attempt to develop a child's mind without paying any regard to its bodily nutrition. Many persons, however, seem to labour under the impression that they have the right to demand from the physiologist who deals with mental functions that he shall tell them more about the real nature of mind than they know of the real nature of any other natural force, and to exult over him when he fails to do so. Not content with his efforts to trace uniformities of sequence, they insist that he shall explain how or why a certain mental sequence is the result of certain antecedent cerebral states. Were they to consider fairly how much they know and do not know concerning other natural forces, they would perceive that it is a preposterous demand to make in respect of mind.

I know not why they should suppose it impossible that a Creator whom they believe to be omnipotent can have endowed matter in its most complex development with feeling and thought, nor why they should be horrified at the suggestion that he has done so. They strangely overlook the fact that the brain is not a dead instrument, but a living organ, with functions of a higher kind than those of any other bodily organ, insomuch as its structure far surpasses in organic dignity that of any other organ. What, then, are these functions if they are not mental? It were wise to ponder well the remarkable operations of which matter is capable, and to reflect upon the wonderful works which it is continually doing before our eyes. Consider the seed dropped into the ground: in due season it springs up as a tender shoot, which grows into a plant that puts forth first its leaves and then its blossoms, making use in the process of a more subtile chemistry than man can yet comprehend or attain unto, until finally it is clothed in such a floral beauty that "Solomon in all his glory was not arrayed like one of these." It is not a spiritual plant which does these things through the agency of matter; they are operations of matter, and wonderful enough, rightly considered, to satisfy any one of the properties that are inherent in it. We cannot choose but believe that the highest and most complex development of organic structure is capable of even more remarkable operations. In truth, when we trace the development of the nervous system step by step through the animal series, from its first germ to its most complex evolution, we shall find it a hard matter to declare at what point it suddenly loses all its inherent properties as living structure, and becomes the passive instrument of an immaterial entity. Those who repudiate such materialism may comfort themselves by conceiving a fine matter of extreme subtility and tenuity, a sort of immaterial matter: whether they spiritualise matter in this way, or materialise mind, is a question of words, not of facts.

The truth is that it has been the custom to dispute violently and vaguely about matter and motion, and about the impossibility of matter affecting an immaterial mind, without being at the pains to reflect carefully upon the different kinds of matter and the corresponding differences of kind in its motions. All sorts of matter, diverse as they are, were vaguely *matter*—no discrimination was made; and all the manifold and special properties of matter were comprised under the general term *motion*. This was not, nor could it lead to, good. As there are different kinds of matter, so there are different modes of force, in the universe; and as we rise from physical matter in which physical properties exist and laws hold sway up to chemical matter and chemical forces, and from chemical matter again up to living matter and its modes of force, so do we rise in the scale of life from the lowest kind of living matter, with its corresponding force or energy, through different kinds of organic elements, with their corresponding energies or properties, up to the highest kind of living matter and corresponding mode of force with which we are acquainted, viz. nerve element and nerve force. But, when we have arrived at nerve element and nerve force, it behoves us not to rest content with the general idea, but to bestow pains on the patient and careful discrimination of the different kinds of nerve-centres in the nervous system, and to study their different manifestations of energy. So shall we ascend to the most exalted agents of mental function, and so only shall we obtain the ground-work of a true conception of the relations of mind and the nervous system.

In like manner as men have disputed vaguely concerning matter, without reaching an adequate conception of that most complex combination of elements and energies, physical and chemical, in a small space, which exists in the smallest atom of nerve element, so has much barren discussion been owing to the undiscriminating inclusion of all kinds of mental manifestations under the vague and general term *mind*. These are important differences in the nature and dignity of so-called mental phenomena, when they are carefully observed and analyzed. By rightly submitting the understanding to facts, it is made evident that, on the one hand, matter rises in dignity and function until its acknowledged energies merge insensibly into functions which are assumed to be purely mental, and, on the other hand, that there are gradations of the so-called purely mental functions, the lowest of which confessedly do not transcend the functions of matter. The burden of proving that the *Deus ex machinâ* of an immaterial agent intervenes somewhere, and where it intervenes, lies therefore upon those who make the assertion or need the hypothesis. They are not justified in arbitrarily fabricating an hypothesis entirely inconsistent with what we know of the orderly development of nature, and which postulates a domain of nature that human sense cannot take cognizance of, and in then calling upon those who reject their assumption to disprove it. These have done enough when they have shown that there are no grounds for nor need of the hypothesis.

The chief feature to be noted in this upward transformation of matter and correlative metamorphosis of force is, that the exaltation or transpeciation on each occasion represents an increased speciality of elements, and a greater complexity of combinations, in a smaller space: all exaltation of matter and force is, as it were, a concentration thereof. As one equivalent of chemical force corresponds to several equivalents of inferior force, and one equivalent of vital force to several equivalents of chemical force; so in the scale of tissues the higher kind represents a more complex elementary constitution, and a greater number of simultaneously acting forces, than the kind of tissue below it in dignity. If we suppose a higher tissue to undergo decomposition, or retrograde metamorphosis of its matter, with which must necessarily coincide a resolution of its energy into lower modes, then we might say that a single monad of the higher tissue, or one equivalent of its force, would equal in value several monads of the lower kind of tissue, or several equivalents of its force. The characteristic of living matter is the complexity of combinations and the variety of elements in so small a compass that we cannot yet trace them; and in nerve structure this complication and concentration is carried to its highest pitch. We may suspect, but we cannot conceive, the complexity of systems and of motions of molecules which exist in the smallest atom of nerve element. Nervous tissue with its energy is, therefore, dependent for its existence on all the lower kinds of tissue that have preceded it in the order of development: all the force of nature could not develop a nerve-cell directly out of inorganic matter. The highest energy in nature is really the most dependent; in the fact that it is so dependent, that it implicitly contains the essence or abstraction of all the lower kinds of energy, lies the reason of the powerful influence which it is able to exercise over all the lower forces that are subservient to its evolution. As the man of genius implicitly contains humanity, so nerve element implicitly contains nature.*

What is the progress or *nisus* that is manifest on surveying nature as a whole? Is it not the struggle to arrive at consciousness, to attain to self-communion? In the series of her manifold productions man was, so to speak, says Goethe, the first dialogue that Nature held with God. Every poet, then, who is sensitive to a hitherto unrevealed subtlety of human feeling, every philosopher who apprehends and reveals a hitherto unobserved relation in nature, opens the door to new discoveries, and is, each in his place, aiding the onward progress; in his art nature is undergoing evolution; in him the world is more or less *regenerate*.

"To whom the wingèd hierarch replied :—
O Adam, one Almighty is, from whom
All things proceed, and up to Him return,
If not depraved from good, created all
Such to perfection, one first matter all,
Indued with various forms, various degrees
Of substance, and in things that live, of life;
But more refined, more spirituous, and pure,
As nearer to Him placed, or nearer tending,
Each in their several active spheres assigned,
Till body up to spirit work, in bounds
Proportioned to each kind. So from the root
Springs lighter the green stalk, from thence the leaves
More aery, last the bright consummate flower
Spirits odórous breathes; flowers and their fruit,
Man's nourishment, by gradual scale sublimed,
To vital spirits aspire, to animal,

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* For the further development of this view of life, I may refer to an article on the "Theory of Vitality," in the *British and Foreign Med.-Chir. Review*, October 1863, which is republished in the second edition of *Body and Mind*, 1873.

To intellectual; give both life and sense,
Fancy and understanding; whence the soul
Reason receives, and reason is her being,
Discursive, or intuitive; discourse
Is oftest yours, the latter most is ours,
Differing but in degree, of kind the same." (4)
Paradise Lost, B. v.

NOTES.

[1] (p. 88). In the first chapter I attributed to Von Baer the formularization of the law of progress from the general to the special in-organic evolution; and it is true that he traced it admirably through the differentiations of the fundamental tissues of the embryo. But it would appear that Von Baer never claimed the law as his discovery, for he says of it—"This law of development has indeed never been overlooked." Mr. Lewes (*Life and Works of Goethe*, 1855) claims it for Goethe. "The law," he says, "announced by Goethe, and I believe distinctly announced by him for the first time, is now to be met with in every philosophic work on zoology. One form of it is known in England as Von Baer's law; viz., That development proceeds from the Like to the Unlike, from the General to the Particular, from the Homogeneous to the Heterogeneous." However, Wolff, in his *Theoria Generationis*, anticipated Goethe.

[2] (p. 91). The doctrine of the relation of the organism to its environment, so far as it belongs to anyone in particular, ought perhaps to be credited to Comte, who, at any rate, recognised its important bearing and laid very great stress upon it when treating of Biology. Lamarck had not, however, failed to perceive and appreciate the powerful action of external circumstances upon the organism, while Blainville, in his *Cours de Physiologie générale et comparée*, clearly points out the modifying effects which are thus produced. The following extracts will suffice to exhibit Comte's conception of the doctrine:—"All biological conceptions must of necessity depend upon two kinds of adjustment; that of the Organism to its Environment, and that of Organs to Functions, or rather of Agents to Acts. . . . No conception in systematic biology can be considered as thoroughly complete until it exhibits these two elementary relations coherently combined." (*Positive Polity*, vol. i. p. 517, Eng. Trans.) . . . "Their study" (that of the special relations of functions to organs) "will be begun and carried on with a distinctly systematic purpose; that of forming a clearer conception of the general relation between the Organism and its Environment; for this, and this

only, is the ultimate goal at which the science of Life aims" (p. 519). . . . "In this more systematic conception of Biology, Function will be regarded as the special result of a determinate relation between Environment and Organism" (p. 520). He speaks of the general theory of organic environments as "an entirely new branch of biology, of which Lamarck must be considered as the true founder, although with him it was too much mixed up with unfounded hypotheses as to the indefinite variability of species" (p. 537). Mr. Herbert Spencer has given the most complete and elaborate development to the doctrine in his *Principles of Biology*; but as Mr. Spencer does not on any occasion give references to or make quotations from authors who have preceded him, but works up their results systematically into his lucid exposition, those who gain all their knowledge of philosophy from the most recent and popular expositions of it, and ascribe to their authors all they find there, are prone to think original that which is often a legacy from the past. This practice of ignoring authorities, though it no doubt has its conveniences, bears hardly and disagreeably sometimes on those who may have occasion to write upon the same subjects, inasmuch as they are liable to be charged by ignorant persons with borrowing from an eminent contemporary what the contemporary has really derived from the same well-known source, and would not claim as his own. This is trying: the most serenely pankleptic appropriator of the fruits of past thought will become recalcitrant when he is charged with specific appropriation of material, not from the real proprietor of the property, who may perhaps not be known by name, but from one who, indebted for it to the same sources in the stores of the past as himself, does not make specific acknowledgments.

[3] (p. 126). The definition of Descartes makes the function the substance. Instead of mind being the thinking substance, the *substantia cogitans*, it is the thinking which is mind—the function of the substance; the substance being the brain. Hamilton's definition is defective on its own ground. By defining mind to be the subject of the various internal phenomena of which we are conscious, he leaves all the mental phenomena of which we are not conscious, and the existence of which he admitted, without any subject; he does not deal with that substratum of *mentality* which is beneath *mentation* or conscious mental function, and which is in the cerebral organization. Cerebral mental function may be conscious or unconscious, active, subactive, or in abeyance; and it is only when the intimate organs of thoughts, desires, &c., reach a certain height of energy that their functions become conscious—that they, in fact, function as consciousness. Mr. Bain's definition seems still more open to animad-

version, as will appear if we alter the wording of it, when it will run thus—mind is the sum total of the experiences of that which has not extension, *that which has not extension being a subject!* What, we may ask, is this subject which has not extension? Surely it stands in need of some definition. Psychologically speaking, moreover, we cannot properly say that a sensation has or has not extension; consciousness does not tell us; the word extension has no meaning when applied to its revelations; the meaning of the word is entirely objective. And if we come to objective experience, we cannot conceive something which has not extension; it is a contradiction, not *something* but *nothing*. We never meet with mind except in connection with matter—with a subject that has extension, and cannot, it seems to me, think of it otherwise. By a process of abstraction, it is true, we may separate mind from matter, as we separate weight from a heavy body, but it is a mere abstraction which corresponds to nothing in nature.

[4] (p. 132). That Milton intended this passage to be sound philosophy is shown by what he says in his *Treatise on Christian Doctrine.* After declaring the inconceivability of God having created the world out of nothing, arguing that it was framed out of pre-existent matter, which proceeded from God, and is incapable of annihilation, he goes on to propound the doctrine that there is no ground for the supposed distinction between body and soul. Matter being "an efflux of the Deity" is plainly capable of intellectual functions. "That man is a living being, intrinsically and properly one and individual, not compound or separable, not, according to the common opinion, made up and framed of two distinct and different natures, as of soul and body, but the whole man is soul, and the soul, man; that is to say, a body or substance, individual, animated, sensitive, and rational. . . . Hence the word used in Genesis to signify soul is interpreted by the apostle, 1 Cor. xv. 45, 'animal.' Again, all the attributes of the body are assigned in common to the soul; the touch, Lev. v. 2—'if a soul touch any unclean thing'; the act of eating, vii. 8—'the soul that eateth of it shall bear its iniquity,' and in other places; hunger—Prov. xiii. 25, xxvii. 7; thirst, xxv. 25, 'as cold waters to a thirsty soul,' Isaiah xxix. 8; capture—1 Sam. xxiv. 11, 'thou huntest my soul to take it.' . . . . But that the spirit of man should be *separate* from the body, so as to have a perfect and intelligent existence independently of it, is nowhere said in Scripture, and the doctrine is evidently at variance both with nature and reason, as will be shown more fully hereafter. For the word soul is also applied to every kind of living being; Gen. i. 30, 'to every beast of the earth, &c.,

wherein there is life'; vii. 22, 'all in whose nostrils was the breath of life, of all that was in the land, died'; yet it is never inferred from these expressions that the soul exists separate from the body in any of the brute creation. . . . . It would seem, therefore, that the human soul is not created daily by the immediate act of God, but propagated from father to son in a natural order. . . . . There seems, therefore, no reason why the soul of man should be made an exception to the general law of creation. For, as has been shown before, God breathed the breath of life into other living beings, and blended it so intimately with matter, that the propagation and production of the human form were analogous to those of other forms, and were the proper effect of that power which had been communicated to matter by the Deity. . . . . For the original matter of which we speak is not to be looked on as an evil or a trivial thing, but as intrinsically good, and the chief productive stock of every subsequent good." Vol. i. p. 188.

Robert Hall, the great Baptist preacher, at one period of his life, held a similar opinion. "I am," he says, "and have been for a long time, a materialist. . . . . My opinion upon this head is that the nature of man is simple and uniform; that the thinking powers and faculties are the result of a certain organization of matter; and that after death he ceases to be conscious *until the resurrection.*" However, "attentive to the voice of heavenly admonition," his biographer tells us, he afterwards abandoned these dangerous speculations, and "buried materialism in his father's grave."—*Memoir of Robert Hall*, p. 32.

CHAPTER III.

THE SPINAL CORD, OR TERTIARY NERVOUS CENTRES; OR NERVOUS CENTRES OF REFLEX ACTION.

OMITTING for the present any mention of the lowest nervous centres of the body—first, because they minister chiefly to the organic life, and little is definitely known about them; and secondly, because something will be said of them incidentally when treating of the Passions—I go on to show forth the functions of the spinal cord. It is not a conducting organ between the outer world and the brain only, but contains many independent nerve centres. A large part of human activity notably takes place without any voluntary control, or even without any consciousness, on the part of the individual; and of these unconscious or involuntary actions a great part is as plainly due to the independent power of reaction which the ganglionic cells of the spinal cord have. If it be cut across at a spot below where the respiratory nerves are given off, all sensation and voluntary motor power are lost in the parts of the body below the section; but if the sole of the foot be then tickled with a feather, the leg is drawn up, though the man is unaware of it unless he sees or is told by others what happens. John Hunter mentions the case of a patient suffering from paraplegia, that is, paralysis of the lower half of the body, in whose legs violent movements which he did not feel were produced when the soles of the feet were irritated. When asked whether he felt the irritation which excited the movements, he replied, "No, sir; but you see my legs do." Such automatic action of the spinal cord, manifest enough in the actions of man, but still more so in those of the lower animals, may be illustrated both from the animal kingdom and from the phenomena of human life.

When the earliest actions of the new-born infant are observed, it is plain that, like the movements of the fœtus within the mother's womb, or the movements of many of the lower animals, they are simply reflex to impressions, and take place without will, or even without consciousness. The anencephalic infant, in which absence of brain involves an absence of consciousness, not only exhibits movements of its limbs, but is capable also of the associated reflex acts of sucking and crying. An infant does not require to be taught to cough; it can expel irritating matter from the bronchial tubes by simple reflex action; but it cannot spit until it has learnt the art. Hence, when it coughs up a quantity of mucus it is almost choked by it, or, another reflex act coming into play, swallows it. The same thing happens in the apoplectic and the dying person when the original reflex functions survive the decay of the acquired automatic functions. But it is from experiments on animals that we have gained our clearest ideas of reflex action. When the head of a male frog which is clinging to the female at the season of sexual congress is cut off, the body maintains its hold, and even when a foot is cut off, clings to her with the stump; if the posterior half of the body be cut away, the anterior half still holds on; but if that part of the cord from which the nerves to the anterior limbs go is destroyed, the hold is loosened at once, just as the grasp of a vice is loosened when a backward turn is given to the tightening screw. A similar relaxation is produced in higher animals by discharge of the energy of the nerve-centres concerned: compare the spasmodic grasp of eager love with the relaxed hold of sated lust. A decapitated frog will draw up its leg with mechanical regularity whenever its foot is pinched or acetic acid is applied to it, the time which elapses between the application of the irritant and the withdrawal of the foot varying according to the strength of the irritant, and hardly varying more than a second at each application if the strength of the irritant is the same.

But there is a well-known experiment which yields even more striking results. Pflüger touched with acetic acid the thigh of a decapitated frog over its internal condyle; it wiped it off with the dorsal surface of the foot of the same side: he thereupon cut off the foot, and applied the acid to the same spot; the animal attempted to wipe it off again with the foot of that side, but, having lost its foot, of course could not. After some fruitless efforts, therefore, it ceased to try in that way, seemed unquiet, "as though it were searching for some new means," and at last it made use of the foot of the other leg, and succeeded in wiping off the acid. When it has done that, the animal will remain at rest for hours, until some new stimulus is applied; it makes no spontaneous movements. Notably we have in this striking experiment not merely contractions of muscles, but combined movements in due sequence for a special purpose; we have actions that have all the appearance of being instigated by will and guided by intelligence in an animal the recognized organ of whose intelligence and will has been removed. So much was Pflüger impressed by this wonderful adaptation of means to an end in a headless animal, that he actually inferred that the spinal cord, like the brain, was possessed of sensorial functions. We have clearly, however, no knowledge that the frog feels the irritation; all we know certainly is that this has induced certain definite movements. Others, who would scarce admit Pflüger's supposition to be true of man, have thought that it might be so of some of the lower animals. Instead of grounding their judgment of the complex phenomena in man on their experience of the simpler instances exhibited by the lower animals, they have applied to the lower animals what I believe to be their subjective misinterpretation of the complex phenomena in man.(1)

It is obviously quite possible to draw another inference from Pflüger's experiment: that the so-called design of an act does not necessarily witness to the co-existence of will, forethought, or consciousness; that actions "having the semblance of pre-designing consciousness" may, nevertheless, be unattended with consciousness.* No doubt there is a definite purpose in the movements which the maimed frog makes, as there is definite purpose in the movements of the anencephalic infant's lips, in the respiratory movements of man or animal, or in such movements as are necessary for coughing, sneezing, and swallowing; but in all these instances the co-ordinate activity is the result of an innate nervous constitution, an original endowment of the nervous centres. In the physiological mechanism of the frog's spinal cord are the faculties of the movements which it makes for self-preservation; it has inherited them as a part of its nature, and without them could hardly live a day. Accordingly we see that the frog acts necessarily and blindly; though it has lost its foot, acts as if the foot were still there, which, were there intelligent consciousness, it plainly should not; and only employs other means when the irritating action of the stimulus continues unaffected by its fruitless movements. As the movement which takes place in a sensitive plant—the *Mimosa pudica* for instance—when it is irritated, is not limited to the spot where the irritation acts, but extends, if this be sufficiently intense, to the whole plant; or as when an insect settles on a leaf of the *Dionæa muscipula*, it is held first by the bending round of the hairs, and afterwards the whole leaf gradually rolls itself round it; or as in certain morbid states of the human organism the continuance of an irritation, which at first only causes slight reflex action, may produce a more general involuntary reaction, or convulsions; so in the frog, the enduring stimulus, which has not been affected by the customary reflex movement, now gives rise to those further reflex movements which are the physiological sequences of the former, and would have been made use of had the creature still possessed its brain. In the constitution of the spinal cord are implanted the capabilities of such co-ordinate energies; and the continuance of the irritation determines the extension of the activity. There takes place an irradiation of the stimulus. But this happens unquestionably without the frog's consciousness, whether or not it happens without a consciousness on the part of its spinal cord; all the design which there is in the movement is of the same kind as the design which there is in the formation of a crystal, or in the plan of growth of a tree. A crystal cannot overstep the laws of its form, nor can a tree grow up into heaven; the particles of the crystal aggregate after a certain definite plan, and thus strictly manifest design. Are we then to assume that, because of the design, there is consciousness in the forming crystal or the growing tree? Assuredly not; and yet it is to such extreme conclusion that the arguments of those who look upon the so-called design of an act as testifying to consciousness logically lead. The design of an act is nothing else but the correlate in the mind of the observer of the law of the matter in nature; and each observer will see in any event exactly that amount of design which he brings with him the faculty of seeing.

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* Very interesting, in relation to this matter, are Prochaska's observations, published in 1784:—"Cum itaque precipua functio sensorii communis consistat in reflexione impressionum sensoriarum in motorias, notandum est quod *ista reflexio vel animâ insciâ vel vero animâ consciâ fiat.*" He gives numerous examples, often given since by other authors, and adds:—"Omnes istæ actiones ex organismo et physicis legibus sensorio communi propriis fluunt, suntque propterea spontaneæ et automaticæ."—*Commentatio de Functionibus Systematis Nervosi*, p. 88. 1784. It must be remembered that Prochaska included the spinal cord under the *sensorium commune.* To the same effect are Unzer's remarks:—"What in them appears to be volitional, only *apoears* so, because we draw conclusions as to other animals from the nature and working of our own minds. What appears to be designed arises from the preordination of nature." *Unzer and Prochaska on the Nervous System.* Syd. Soc. Transl., p. 323.

Although we have good grounds for affirming that the movements of the frog which has been deprived of its hemispheres may be explained satisfactorily without the assumption that its spinal cord possesses feeling and will, there are persons of eminence who hold positively that the experiments prove the diffusion of these functions through the nerve-centres of the lower animals. In support of this opinion, they instance further the fact that when an insect is cut in two the forepart of the body may continue to eat, while the hind part continues the act of sexual congress, as proof that the will to eat and the feeling of appetite lie in the former, the will to sexual congress and the feeling thereof in the latter. It sometimes happens, again, when an earwig is cut in two, that the divided parts of the body turn on each other, and fight with fury and passion until death or exhaustion ends the fray; an event which could not be, they say, unless there were consciousness and will in each part. They believe, therefore, that consciousness and will may undergo as many divisions as there are separate nerve-centres in the body. Some go yet farther, and refuse to limit will to the nervous system, holding that they observe clear evidence of its action where there is no trace of either muscular or nervous fibres. If a polype be placed in a glass of water, and if a living infusory animalcule be put in the water, and brought near to the polype, the latter perceives it somehow, and thereupon raises a whirlpool with its tentacles in order to bring it within their grasp and drag it into its stomach: an instance, it is said, of feeling and will in a creature which has neither muscle nor nerve. Assuredly they are logical in this extension of their theory; but when they have endowed the polype with these conscious functions, they will do well to take heed that they are not suffering themselves to be beguiled by words, and to reflect whether there lurks not some obscurity and confusion in the use which they make of the words consciousness and will; whether, in fact, they mean anything like the same things when they speak of the consciousness and the will of a polype, and when they speak of human consciousness and will. The dispute with their opponents must be vague and endless unless they agree upon some more precise definition of terms in accordance with the undoubted diversities of the facts. It will not advance knowledge to identify phenomena of a different kind by giving them the same name; on the contrary, the progress of knowledge lies in following the specializations of development, and in defining differences by a precise use of terms. The matter may be put briefly thus: does feeling imply that which a person means when he says—*I* feel, *I* am conscious? If it does, one cannot believe that the polype or the spinal cord has feeling; if it does not, then some other term than feeling should be used to denote organic susceptibilities, or that so-called feeling which the individual has not as an *ego*, but which the least particle of his living protoplasm is assumed to have.

In trying to determine whether the spinal cord is endowed with feeling and will, we shall do well to consider how very small a part of a conscious and voluntary movement we are really conscious of. We know the end or aim of the movement, and we know that we give the order to accomplish it; but the actual execution of it is left to the organized mechanism, innate or acquired, of the motor centres and their connections. The main part of a voluntary act is truly the automatic action of the spinal cord; and the will is absolutely dependent upon the automatic mechanism for the accomplishment of its acts, while this may operate by itself independently of the will. It is clear, then, that the conscious has essential need of the automatic, while the latter has no need of it. Consciousness is a superfluity so far as the execution of the act is concerned, being, when it occurs, merely a co-effect. Instead of attributing consciousness to the function of the spinal cord, the lesson of nature teaches us rather to proceed in the opposite direction, and to take out of a voluntary act the large part which is strictly automatic, and which, the impulse once given, would be done as well without as with consciousness. It is well known that the impulse to an act which was first voluntary may, after the act has become habitual, be a stimulus from without; for movements that were at first executed consciously oftentimes become unconscious, and are done in answer to external stimuli. We remove an irritation which is acting upon some part of the body, as for instance a fly on the forehead, without being conscious of what we have done, unless we reflect afterwards. We have certainly no clear conception of the place of the irritation, or of the character and measure of the muscular exertion which we make, and we can hardly suppose that a dim consciousness or obscure conception would suffice to make so nice and exact an adaptation as takes place: a supposition which would nevertheless have to be made if the adaptation were dependent on consciousness. Are we then to entertain seriously the more improbable assumption that the spinal cord has such an exact consciousness? And yet this is an assumption which those must make who believe that the spinal cord feels impressions and responds to its feelings by exact purposive movements. The organized mechanism is the real automatic agency, and we shall see hereafter that the exact faculty of accomplishing the act has been organized in it, built into its nature, so to speak, by previous training and experience.

What we have to realize is that the afferent nerve is adapted to receive a certain impression and to convey it to the nervous centre, and that, the impression made, it does so receive and convey it whether we are conscious of it or not; that when the impression reaches the centre, it stimulates the energy which is latent in it, whether we are conscious of it or not; and that this energy then acts upon the afferent or motor nerve, and accomplishes the movement through the agency of the proper muscles, which we could not even select consciously if we would. It is entirely a physical process, which is nowise prevented from taking place because it is not accompanied by consciousness. Our own experience, rightly interpreted, is adverse, then, to the opinion that the movements of the decapitated frog evince that its spinal cord is endowed with consciousness. It is hardly conceivable, if it were so endowed, that the creature should never make a single spontaneous movement; that it should remain perfectly quiet until a new stimulus is applied; that its activity should be proportionate to the stimulus; and that it should not profit by its experience of previous excitations, notwithstanding that it is supposed to have so nice a consciousness of the place of the irritation and of the exact movements proper to relieve its sufferings.

The way in which such movements as the mutilated frog makes may be prevented, furnishes further evidence of their mechanical nature. In the experiment in which its leg is regularly drawn up on irritating its foot, it has been found by Nothnagel that no effect is produced if the sciatic nerve of the other leg is irritated by a faradic current. This is an instance of what is called inhibition: some change is produced in the motor centres of the cord, which operates to inhibit or prevent the movement. Does not this experiment strengthen our conception of the entirely physical nature of the movements? Take another example of reflex action similarly prevented. After division of the spinal cord in dogs, Goltz discovered that by touching the anus with a wet sponge, or tickling it, and by touching or pressing the foreskin, the sphincter of the bladder was relaxed, and a stream of urine expelled, at first in a steady stream, and afterwards in jets, from the action of the bulbo-cavernous muscles. The contraction of these muscles was at once arrested by pressing on the foot of the animal. It may, of course, be said that these facts really furnish evidence that the spinal cord feels, and that the proper interpretation of them is in this wise: feeling the stimulus to the foreskin it responds by relaxation of the sphincter and contraction of the bulbo-cavernous muscles, but when a new impression from the foot reaches it, its attention is distracted thereby, and it no longer feels the first impression. Let who will choose this conception: to me it appears to be the imagination of the phenomena of an unconscious consciousness, and an unwarranted application of ideas derived from experience of the highest nerve-centres to the interpretation of the phenomena of much lower centres. It is because of the adaptation to a purpose which these movements effected by the spinal cord show, because of the design manifest in them, that so many people find it hard to believe them to be purely reflex and unconscious; they seem to have an insuperable difficulty in realising that adaptive reaction is a radical property of living organic matter, and that conscious design is itself but a manifestation of this property in the highest nerve-centres.

Much fruitless theory would have been avoided if the real nature of design had been kept distinctly in mind. The notion that the soul works unconsciously in the building up of the organism, which has at different times been so much in vogue, rests entirely upon the assumption that an intelligent principle or agent must be immanent in organic matter which is going through certain definite changes. But if in the development of an animal, why not in the growth of a tree, which fulfils an equally definite plan, adapting itself wisely to its surroundings? If in the formation of an organ, why not also in the formation of a chemical compound with its characteristic properties? The function is the necessary result of a certain definite organic structure under certain conditions, and in that sense must needs minister to the furtherance of its well-being.* But an organic action, with never so beautifully manifest a design, may, under changed conditions, become as disastrous as it is usually beneficial; the peristaltic movements of the intestines, which serve so essential a purpose in the economy, may, and actually do, in the case of some obstruction, become the cause of intolerable suffering and a painful death. Where, then, is the design of their disastrous continuance? The process of repair in a ruptured urethra will, instead of restoring the integrity of the canal and then coming to a stop, go on, with a final purpose singularly and obstinately mischievous, to produce an obliteration of the canal, unless human art come to the rescue. M. Bert has made many extremely interesting experiments on grafting parts cut from the body of one animal on to that of another. For example, he cut off the paw of a young rat, and grafted it in the flank of another rat; it took root there, and went through its normal growth, beginning to dwindle after a time. Where was the design of its going through its regular development there? Or what, in the temporary adoption and nutrition of this useless member, was the final purpose of the so-called intelligent vital principle of the rat on which the graft was made?

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* The proper course would be to reverse the method of our inquiries and conclusions, and, instead of discovering the operations of soul in the processes of organic growth and development, to discover the properties of matter that are evinced by organic growth and development to operate in the construction of soul—to place our feet firmly upon the lower steps before we attempt to go up higher. That appropriation of matter of force and concentration thereof in its substance which organic element accomplished when it was first formed out of inorganic matter, and accomplishes constantly now when it increases and multiplies in plants and animals at the cost of inorganic matter, is what a higher tissue, like nervous tissue, does, with increasing complexity, when it is developed out of a lower tissue, and what is displayed, in a still higher degree of complexity, in the development of the mental structure and functions of the supreme cerebral centres.

The idea of design is really a conception which we form from repeated experiences of the law of the matter —a law fulfilling itself in the effect necessarily, fatally, blindly—and to which we transfer our experience of an event or end willed by us, and accomplished, not directly, but indirectly through intermediate steps or means. We are not in the habit of speaking of an immediate effect as the aim or design of the cause—of the evolution of heat, for example, as the design of combustion, or of the properties of a chemical compound as the design of its combining elements; but when a cause works effects, which in turn become causes of further effects and so accomplish finally a certain definite result, or when a concurrence of circumstances has led to an event, we recognize in the series of operations or the concurrence of conditions a suitability or so-called adaptation of causes and conditions to the final effect; thereupon we pronounce this to be the aim or design of them, because if we consciously willed the effect, and brought it about through such a chain of means, we should say rightly that we had designed it. The more complex the process, so long as we perceive that it works out a definite result, the more we are struck with admiration of the design. Hence it is that organic nature is the fruitful field of final causes. But it is certain that when men have thus transferred to nature the experience of their imperfect working through means to an end, and have concluded the existence in it of a mind like their own, they have made a conception of God after their own image, which, as Spinoza remarked, divests him of his perfection. "For if God acts for an "end or purpose, he necessarily desires something which "he is without."*

It will not be amiss to take note here of the very different way in which we are in the habit of regarding dead matter and living matter. In dead matter the form is looked upon as the attribute of the matter; whereas, on the other hand, in living bodies the matter is treated as the attribute of the form: in inorganic nature the matter is the essential thing, in organic nature the form is all in all. We cannot get rid of the notion of some mysterious potency in organic form which controls the action and determines the disposition of matter, because we cannot get rid of the notion of matter as inert or dead. But matter is not inert; not the smallest particle of it which is not a complex system of atoms in most active and complicated movements; and to neglect the exact consideration of the conditions and combinations of matter, as determining organic form, is not less mischievous than it is to concentrate all attention upon matter in inorganic nature. What are inseparably joined together in nature let us not vainly attempt to put asunder. Mindful of this maxim we shall not be so much tempted to fall back upon that vague and shifting doctrine of final causes which has done so great harm in science, or, as Bacon has it, has strangely defiled philosophy, and which, though often rejected absolutely, and now banished from the more advanced sciences, still works injuriously in biology, where so much is yet recondite and obscure.(²) The human understanding can indeed best impose its own rules on nature in that province where the truth is most inaccessible and least known. Not only does it in biology look for a final cause answering to its own measure, but, having found this, or created it, proceeds straightway to superadd its own attribute of consciousness, so that wherever evidence of design is met with, be it only in the function of the spinal cord of a decapitated frog, there consciousness is assumed. Is it not a marvel that no teleologist has yet been found to maintain that the final cause of the moon is to act as a "tug" to the vessels on our tidal rivers; or that the final cause of the redness of human blood is to facilitate the detection of the murderers who shed blood?

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* Spinoza. *Ethics:* Part I., Appendix. Translated by R. Willis, M.D. p. 448.

There can be no difficulty in admitting that the spinal cord is an independent centre of so called aim-working acts that are not attended with consciousness. It is the centre, however, not only of co ordinate action the capability of which has been implanted in its original constitution, but also of co-ordinate action the power of which has been gradually acquired and matured through individual experience. Like the brain, the spinal-cord has, so to speak, its memory, and must be educated; the reaction which it displays, in consequence of a particular impression conveyed to it from without, does not vanish issueless, leaving the track unmodified after the function has been discharged. With the display of energy there is a coincident change or waste of nerve element; and, although a subsequent regeneration or restoration of the statical equilibrium takes place by the quiet process of nutrition, yet the nutritive repair, following the track of the energy and coincident material change, registers the experience. It is not an integration only which is accomplished, but a *re*-dintegration; the substance is made whole after a particular exercise of function—*after* in pattern as well as time. Thereby the definite activity is to some extent realized or embodied in the structure of the spinal cord, existing there for the future as a motor residuum, or as, so to speak, a *potential* or *abstract* movement; accordingly there is thenceforth a tendency to the recurrence of the particular activity—a tendency which becomes stronger with each repetition of it. Every impression which is made leaves behind it, therefore, its trace or residuum, which is again quickened into activity on the occasion of an appropriate stimulus; the faculties of the spinal cord are thus gradually formed and matured. We may easily note in the acquirement of a complex purposive movement the difficulty which there is at first in defining the path of the stimulus and directing it exactly to the proper muscles —in limiting the excitation; and we shall not fail to note hereafter that this is done, not by willing to put these muscles in action, but by clumsily imitating the movement until we attain to an exact imitation, or by making many trials of movements until we find out the most suitable one, and so get an unconscious mastery of the proper muscles. The path must be made, and the more often it is trodden the more distinct will it be: awkwardly through trials and blunders we fall into the adjustment which we afterwards perfect by experience.

When a series or group of movements is, after many voluntary efforts, associated, they notably become more and more easy, and less and less separable, with every repetition, until at last they are firmly fixed in the constitution of the cord, become a part of the faculty of it, and may be accomplished without effort or even without consciousness: they are the *secondary* or *acquired automatic* acts, as described by Hartley.(3) Once the track has been laid down it is easier for the stimulus to follow it than to leave it, just as it is easier for a train to run on the rails than to run off them, or for water to run in its channel than to run out of it. In this way walking becomes so far a reflex or automatic act that a man in a profound abstraction may continue to walk without being conscious where he is going, and find himself, when he is aroused from his reverie, in a different place from that which he intended to visit. In that form of epilepsy known as the *petit mal* an individual sometimes continues automatically, whilst consciousness is in abeyance, the act which he was engaged in when the attack seized him: a shoemaker used frequently to wound his fingers with the awl as he went on with his work, and on one occasion walked into a pond of water during the suspension of consciousness; and a woman whom Schroeder van der Kolk knew used to continue eating or drinking, or the occupation she was about, being quite unconscious on recovery of what had happened. Trousseau mentions a young amateur musician subject to epileptic vertigo, who sometimes had a fit lasting for ten or fifteen seconds whilst playing the violin. Though he was perfectly unconscious of everything around him, and neither heard nor saw those whom he was accompanying, he still went on playing in time during the attack. The same author also mentions an architect who had long been subject to epilepsy, and did not fear to go up the highest scaffoldings, though perfectly aware that he had often had fits while walking across narrow planks at a considerable height. He had never met with an accident, although, when in a fit, he ran rapidly over scaffoldings, shrieking out his own name in a loud and abrupt voice. A quarter of a minute afterwards he resumed his occupation and gave his orders to the workmen; but unless he was told of it afterwards, he had no idea of his strange behaviour during the fit.* In fact, if any one attends to his ordinary actions during the day, it will be surprising how small a proportion of them are consciously willed, how large a proportion of them are the results of the acquired automatic action of the organism. It is sufficiently evident that the faculties of the spinal cord are, for the most part, not inborn in man, but gradually built up by virtue of experience and education; in their formation they illustrate the progress of human adaptation to external nature.

Certainly the capability of associated voluntary movements, or the germ of such capability, does appear to exist as an innate endowment of the spinal cord even in man; ready to come into action at the proper epoch of that development which goes on in him after birth, under the influence of suitable external conditions, until he reaches maturity. As the young animal, directly it is born, can sometimes use its limbs with complete effect, or as the infant, previous to any experience, is capable of that association or catenation of movements necessary to crying, breathing, or coughing, so soon as it meets with suitable external conditions; so likewise does there appear to be, as Mr. Bain argues,† the germ of a locomotive harmony in the original conformation of the nervous centres of man which develops rapidly at the proper epoch. Not only does the analogy of the lower animals favour the belief in the original existence of such an associating link, but the tendency to an alternate action of the lower limbs, and of the two sides of the body, observably precedes any acquisition of experience. Before a child can walk it will make alternate movements of its legs when it is held with its feet touching the ground. There is, furthermore, a proneness to the involuntary association of the motions of corresponding parts of the two sides of the body; and, as Müller has observed, the less perfect the action of the nervous system in man, or the less developed volition is, the more general are the associate movements. It would be a fruitless task, however, to attempt to fix the value of this pre-established arrangement in man, where it is obviously at best rather a potentiality than an actuality; for all practical purposes, we must view the faculties of

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* "Their condition may be compared to somnambulism, or better still to what happens in the case of certain individuals who answer questions during sleep, but do not recollect anything when they wake up."—TROUSSEAU, *Clinical Lectures*, vol. i., p. 60.

† *The Senses and the Intellect*, 2nd ed. It has long been distinctly recognized as a general law that when a moderate stimulus excites several motor nerves, these are physiologically connected: first, inasmuch as all the fibres going to a particular muscle are simultaneously excited, so that partial movement of the muscle does not take place; secondly, as the regular reflex activity implicates such muscles as are functionally co-ordinated, the associated action of which produces certain physiological effects—*e.g.*, coughing, sneezing, swallowing. In the electric fish, the malapterus, the nerve going to the electric apparatus is at first a single fibre which divides and subdivides in its course, until it furnishes as many branches as

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there are electric plates; so that the creature cannot isolate a part of the apparatus, but must put all the plates into action together. As Sir C. Bell has remarked, "a child smiles before anything incongruous can enter the mind, before even pleasure can be supposed a condition of the mind. Indeed, the smile on the infant's face is first perceived in sleep." Its forefathers have smiled, and it is the heir of their acquisitions. Contortions of its face from pain or uneasiness are witnessed long before smiles (*The Hand; its Mechanism and Vital Endowments*). The locomotive harmony is the result of the connections of certain cells and groups of cells in the nerve-centres. "Si l'homme, le lapin, le moineau, le pigeon, ne marchent pas dès leur naissance, c'est uniquement à cause du développement incomplet des divers organes, et surtout, sans doute, des centres nerveux. Si l'enfant naissait en présentant un degré de développement égal à celui qu'offre le cochon d'Inde, il marcherait dès le premier jour."—VULPIAN (*op. cit.*), p. 529. What happens in the infant's nerve-centres when it does learn to walk, we know not: it may be that an actual growth of nerve-cells and of their connections takes place in the course of such education; or it may be that pre-existent cells and connections are gradually differentiated in function.

his spinal cord as acquired by education. The child certainly has the capability of learning to walk, but the actual process of learning involves the expenditure of much time and energy, and represents a progressing development of the spinal cord : it is the faculty thereof in the making. Of course it is not to be supposed that the spinal centres of themselves suffice ordinarily for all the complicated movements of walking, although they may do so : all that is claimed is, that they are the automatic centres of certain associate movements which have been acquired, and which constitute a large part of our daily action.*

This power of co-ordinate action, which the spinal centres acquire by assimilation of the influence of the individual's surroundings and respondent reaction thereto, is plainly a most useful, as it is a most necessary, provision of nature. For if an act became no easier after being done several times, if the careful direction of consciousness were necessary to its accomplishment on each occasion, it is evident that the whole activity of a lifetime might be confined to one or two deeds—that no progress could take place in development. A man might be occupied all day in dressing and undressing himself; the attitude of his body would absorb all his attention and energy; the washing of his hands or the fastening of a button would be as difficult to him on each occasion as to the child on its first trial; and he would furthermore be completely exhausted by his exertions. Think of the pains necessary to teach a child to stand, of the many efforts which it must make, and of the ease with which it at last stands, unconscious even of an effort. For while secondary automatic acts are accomplished with comparatively little weariness—in this regard approaching the organic movements, or the original reflex movements—the conscious efforts of the will soon produce exhaustion. A spinal cord without that power of retention which in the higher centres we call memory would simply be an idiotic spinal cord incapable of culture—a degenerate nervous centre in which the organization of special faculties could not take place. It is impossible for an individual to realise how much he owes to its automatic agency until disease has impaired its functions: and it is the lesson of a good education so consciously to exercise it in reference to its surroundings that it shall act automatically, in accordance with the relations of the individual in his particular walk of life.

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* Schroeder van der Kolk, after saying that the production of harmonized movement is due to the ultimate connection of certain groups of ganglionic cells in the spinal cord, goes on to say—"It has always been incomprehensible to me, how any one could ever have referred it (co-ordination) to the cerebellum. If the cause of the co-ordination lay in the cerebellum, no harmonixed reflex movements could take place in a decapitated frog."—*On the Minute Structure of Spinal Cord and Medulla Oblongata*, p. 72. The supposition that the cerebellum is the sole centre of co-ordination of movements is now, in fact, abandoned as untenable. There never was any real scientific evidence to support it, while there was positive evidence against it. (See *Versuch einer physiologischen Pathologie der Nerven*, von. G. Valentin, 1864, vol. ii., p. 68.)

The phenomena of secondary automatic action are well fitted to exhibit the mode of origin and the nature of what we call design. It is here seen to be an acquisition that is gradually organized in respondence to particular experience and education; representing as it does, the acquired nature of the nervous structure, its manifestation is the simple result of the constitution of the material substratum, just as the properties of any chemical element are the unavoidable result of its nature. To say that means are adapted to the production of an end in the phenomena of life, is but another way of saying that what we please to call life exists; for if means or causes were not adapted to the end or effect, there could plainly be no end; and if we perceive, or choose to assume, a certain result to be the end of certain means, then we are but saying that, according to our experience, certain combinations of matter have certain definite properties. The vulgar doctrine of final causes contravenes nature entirely, assuming as effect that which is truly cause, and as cause that which is truly effect. In the building up of the secondary automatic faculties of the spinal centres, we are able to trace through the course of its formation in individual life that design which we meet with fully formed in the innate faculties of so many animals; but which even in that case has been, as we shall hereafter see, gradually organized through generations. If it be said that the gradual building up by education of this embodied design into the constitution of the nervous centres is itself evidence of design, then we can only answer that such proposition is merely a statement in other words of the fact that things are as they are, and add the expression of a conviction that science cannot enter into the councils of creation. Certainly nothing is gained by taking refuge in that 'asylum of ignorance—the Will of God.' The growth of a cancer until it kills the body, or of a vice until it ruins the mind, is neither more nor less evidence of design. Should these considerations not be satisfactory to the teleologists, it will be sufficient to recall to them the already quoted remark of Spinoza, and to congratulate them on their power of diving into "the mysteries of things, as if they were God's spies." Were it not well, however, that they should condescend to humble things, and unfold to us, for example, the final cause of the rudimentary mammary gland and nipple in the male animal? *

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* A task which, after all, is perhaps not inconceivably difficult. For example: we know that the male integrates the qualities of its *male* and *female* ancestors, having them potential or actual, and transmits them to its progeny: may we not conceive, then, that the rudimentary gland in it is a necessary condition of such complete inheritance and transmission, integrating the mammary characters; and that, if the male were without it, it would be impossible for the

As the faculties of the spinal cord are built up by organization, so must they be kept up by due nutrition. If not so preserved in vigour, if exhausted by excesses of any kind, the ill effects are manifest in degenerate action; there is, so to speak, a decomposition of its composite motor functions; instead of definite co-ordinate action ministering to the well-being of the individual, irregular spasmodic or convulsive movements ensue, which, though inevitable consequences of the degenerate condition of the nerve centres, serve no good end, but have strangely forgotten their beneficial design.* Sir James Paget has made the probable suggestion that the rhythmical organic movements, such as those of the heart, of respiration, of the cilia, are due to a rhythmical nutrition; that is, "a method of nutrition in which the acting parts are, at certain periods, raised, with time-regulated progress, to a state of instability of composition, from which they then decline, and in their decline discharge nerve-force."† It may be easily conceived, therefore, why they are never tired when acting naturally; between each succeeding act of function a nutritive repair takes place, and the time of each occurrence of the movement represents the time-rate

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influences of *its* female ancestors to take effect in the mammary development and function of *its* female progeny, as we have good reason to believe they do? But, it may be said, if this argument is valid, it would involve this necessity: that the male shall have every organ which the female has, and the female every organ which the male has. Well, so they have; or, at any rate, they have organs that are the homologues of one another. At one period of development we cannot distinguish the male from the female; the subsequent differences being produced by the female stopping short on, and diverging a little from, the track of development on which the male goes forwards.

* They have, no doubt, their design quite as much as the healthy movements, in so far as they accomplish what they cannot help doing, their destiny—in other words, fulfil the law which necessitates them.

† *Croonian Lecture before the Royal Society*, 1857.

of nutrition. When the heart is made to beat slowly by stimulation of the vagus nerve it will continue to beat for a long time, but when its pulsations are quickened by irritation of the sympathetic nerve, it soon becomes exhausted and stops, owing no doubt to exhaustion of its motor centres in consequence of nutrition being unable to keep pace with the quickened action. But the spinal centres are equally dependent on nutrition for the maintenance of the functions which they discharge in the animal life; the structural or chemical change produced by the ordinary activity of the day must be repaired during a period of cessation of action. This restoration we believe to take place during sleep; and there is some reason to believe that the periodical action of the spinal centres is, like rhythmical organic movement, dependent upon, or closely related to, the time-rate of nutrition. The unconscious quiet manner in which the automatic function of the spinal centres is performed, though in one way or another the work is continuous during waking, might seem at first sight to render no cessation of action necessary; but a little reflection shows that, here as elsewhere, the expenditure of force must be balanced by a corresponding supply; there must be alternation of activity and repose. If no rest be allowed, the exhaustion is evinced, first, in an inability to accomplish successfully the most delicate or complex associated movements—in a loss, that is, of design; then in trembling incapacity, which, if the degeneration increases, may pass on to actual spasmodic movements and finally to paralysis. Therein we have sure evidence that the constitution of the nerve element has suffered from the drain of energy.

A reflection which occurs, in considering the nervous mechanism by which the action and reaction between the individual and nature take place, is as to the disproportionate exhibition of force by the organism to the force of the simple impression which may happen to be made upon it. How, with due regard to the principle of the conservation of force, do we account for this seeming generation of energy? In the first place, the central nerve cell is not a simple impassive body, which merely reflects or passes onwards a received current of activity, without affecting it or being affected by it: on the contrary, it is the complexly constituted, supremely endowed centre in which force is released or evolved on the occasion of a suitable stimulus; and that which is perceived, as it were, in the spinal cord is not the actual impression made upon the afferent nerve, but it is the effect produced in the particular central nerve cell or cells. It is not hard to conceive how this force or energy is evolved, or, as it were, let loose in the cell. By the disturbance of the statical equilibrium of an intensely vital structure; by a change of the material into lower kinds, or a degeneration of it, and a correlative resolution of its force into lower modes and larger volumetrical display. There is not any actual generation of energy; there is a transformation of the high quality of latent or potential energy which the nervous monad implies into actual energy of a lower quality and larger display. The little change or motion which the impression makes at the extremity of the afferent nerve is propagated along the nerve and produces a much greater change or motion in the unstable nerve element of the central cell; an explosion of molecular energy, so to speak, is occasioned, which thereupon is propagated in different directions to other cells, where it is similarly multiplied; the final result being the release of sufficient energy to accomplish the act. If, as has been calculated, the consumption of half a pound of carbon would produce an amount of heat which, if expressed in its equivalent of mechanical force, would be enough to raise a man of average weight to the highest summit of the Himalayas, it is clear that the oxidation of the complex carbon compounds of the nerve element is sufficient to account for the nerve force which is liberated in its function. Consider what has been previously said as to the nature of nerve element and its position in the universe, it will then be sufficiently evident what manner of process it is that takes place. Slowly and, as it were, laboriously, by a steady appropriation and ascent through many gradations of vitality, does organic element arrive at the complex and supreme nature of nerve structure; quickly and easily does nerve element give back force and matter to nature, in the rapid resolution which the accomplishment of its function implies. (4)

Thus much concerning the inherent force of the spinal cord as a nervous centre. In the second place, bear in mind the nature of its acquired faculties, and the great expenditure of power made upon its education. In the registration of impressions made upon it, in the assimilation of their residua, there is slowly embodied a quantity of energy as an organic addition of power; force is being stored up in the gradual organisation of its faculties. The exhaustion which we feel from our efforts to acquire any particular skill of movements, as in learning to dance, the labour given to the frequent voluntary repetition of the stimulus and adapted reaction thereto, until by practice the definite relation has been established, and the desired skill acquired;—these testify to the expenditure of so much force which has been laid up as potential in the constitution of the ganglionic cells of the cord, rendering possible for the future the easy performance of a group of associated movements in answer to a moderate and, as might often seem, disproportionate stimulus from without. Like the brain, the spinal cord lays up good store of power in its memory. Man's life truly represents a progressive development of the nervous system; none the less so because it takes place out of the womb instead of in it. The regular transmutation of motions which are at first voluntary into secondary automatic motions, as

Hartley called them, is due to a gradually effected organisation in the proper centres; and we may rest assured of this, that co-ordinate activity always testifies to stored-up power, either innate or acquired.*

The way in which an acquired faculty of the parent animal is sometimes distinctly transmitted to the progeny as a heritage, instinct, or innate endowment, furnishes a striking confirmation of the foregoing observations. Power which has been laboriously acquired and stored up as statical in one generation, manifestly in such case becomes the inborn faculty of the next; and the development takes place in accordance with that law of increasing speciality and complexity of adaptation to external nature which is traceable through the animal kingdom; or, in other words, that law of progress from the general to the special in development which the appearance of nerve force amongst natural forces and the complexity of the nervous system of man both illustrate. As the vital force gathers up into itself inferior forces, and might be justly said to be a development of them, or as in the appearance of nerve force simpler and more general forces are gathered up and concentrated in a more special and complex mode of energy; so, again, a further specialisation takes place in the development of the nervous system, whether watched through generations or through individual life. Not by limiting our observation to the life of the individual, who is but a link in the chain of organic beings connecting the past with the future, shall we come at the full truth; the present individual is the inevitable consequence of his antecedents in the past, and through the examination of these alone do we arrive at the adequate explanation of him. It would be the function of an exhaustive psychology, having found any faculty to be innate, not to rest content there, but to follow steadily backwards the line of causation, and thus to display, if possible, its manner of origin. This is the more necessary with the lower animals, where so much is innate.

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* The description of the spinal functions as *reflex* is not entirely free from objection, because the term is apt to convey the idea that the centripetal current of the afferent nerve is simply reflected on to the efferent nerve and becomes the centrifugal current; whereas, as has been pointed out, the affair in the spinal centres is much more complex than that. We mean by reflex action function which is performed by the nervous centres, so far as we can judge, without will or consciousness—mechanically; not by virtue of any mysterious mental agency, but by virtue of the properties of the nerve structure.

Thus much concerning the general functions of the spinal cord as an aggregation of independent nerve centres, so far as they bear directly upon psychology. It must not be supposed that I have given an exhaustive description of its functions in the animal economy. I have spoken of its intermittent activity, but it must be remembered that it is also in a state of continuous activity; the permanent contraction of the sphincter being due apparently to a continuous influence exerted upon the motor nerves by its ganglionic centres. In like manner, all muscles that have antagonists, as, for example, the flexors and extensors of the arm, are kept in a certain degree of counter-activity, maintain a certain tonicity, as is immediately evident when their antagonists are paralyzed; this tonicity disappearing at once when the part of the spinal cord from which the motor nerves proceed is destroyed. It appears also to be of a reflex character, as it disappears when the excito-motor or sensory nerves of a part in a state of tonicity are cut. But we may go even farther, and discover the functions of the spinal cord at work in the intimate processes of organic activity. Take one example of this far-reaching action. Certain blood-vessels are kept in a state of moderate contraction by the influence of vaso-motor nerves proceeding from ganglia lying close to the vessels, which ganglia are connected by nerves with the spinal cord. When these nerves are irritated the action of the ganglia is inhibited; they cease to stimulate the walls of the vessels, which thereupon dilate and are filled with blood, so that the organ in which they are distributed becomes swollen and turgid. After the irritation of the nerves has ceased, the ganglia regain their power and cause the vessels to contract, so that the organ becomes flaccid. It appears, then, that a stimulus to the nerve centres of the spinal cord has several outgoing channels of activity: it may act on the muscles, voluntary or involuntary, of the body, producing visible movements; or it may act upon the vessels, enlarging or diminishing their calibre, and so modifying the nutrition and function of the parts supplied by them; or it may, as other experiments have shown, act directly upon the elements of a tissue, and so affect directly nutrition and secretion; or it may pass to other nerve centres, and so occasion a variety of indirect effects. How manifold, far-reaching, and important these indirect effects may be, the experiments before-mentioned on the frog and the dog will help us to realise. When we find movements that are going on to be suddenly arrested by a new stimulus to the spinal cord, and consider what a complicated mechanism it is, and how many stimuli it receives, we may imagine vaguely what a variety of intricate and complicated functions, though we wot not of them, it is continually discharging every moment of our lives.

It is not within the scope of this work to describe those special functions of the spinal cord which belong more properly to a treatise on physiology; I am mainly concerned with those more general reflex functions which play so large a part in human activity, and which have, therefore, an essential place in psychology. An accurate knowledge of them affords the only solid basis from which to prosecute inquiry into the functions of the higher cerebral centres. We have seen that the spinal cord possesses that power of retention which in the higher centres we designate memory; that by virtue of this power an act done for the second time contains something from the first act, and is done easier on that account; that the faculty is strengthened by exercise, as memory is, until it becomes completely automatic; and that an association or catenation of movements may be organised in the nerve centres, whereby movements that have taken place together several times may finally be so firmly bound together that there may be the greatest difficulty, or it may be actually impossible, to separate them, just, in fact, as ideas may be associated in the supreme cerebral centres. A spinal cord will do the acts, simple or complex, which it has inherited from ancestors or acquired by education the faculties to do, but if required to do new and strange acts, to associate in action muscles which have not acted together before, it will manifest an utter stupidity and impotence. It is an organised mechanism for the accomplishment of the former; it must be gradually organised as a mechanism in order to accomplish the latter.

It may not be amiss to add that the reflex functions of the spinal cord were distinctly recognised by the physiologist long before the anatomist was in a condition to give the physical explanation. It is only recently that the nerve fibres which pass to or from the spinal cord have been proved to be connected with the unipolar, bipolar, and multipolar cells of its grey substance; and this so plainly as to justify the belief that an isolated apolar nervous cell does not exist in the spinal cord or brain. For the conveyance of an impression to the grey centres, and for the passage of the reacting force outwards, there is thus revealed a definite physical path, along which the current of molecular activity travels. From the cells with which nerves are connected, again, other processes go to join neighbouring cells, and thus, forming a connecting path between them, enable them to act together: hundreds of ganglionic cells are yoked together by such anastomoses, and, functionally co-ordinated thereby, represent the centres of innervation of corresponding systems of motor nerves. By similar anastomoses the ganglionic cells of different nervous centres are connected, and in this way a means is afforded for the communication of the activity of one centre to another. A consideration of the nervous system of the Annelida will assist in the conception of the physiological nature of the spinal cord. In those humble creatures the central nervous system consists of a ganglionic apparatus, each separate ganglion of which is united to that which precedes it, and to that which follows it, by longer or shorter nervous connexions.* Now the spinal cord of the Vertebrata may be considered as an analogous ganglionic apparatus, the connecting cords of which are not seen by reason of the coalescence of the ganglia. From a physiological point of view, therefore, the grey substance may be considered as formed of distinct segments, each segment consisting of a group or association of cells, and having connected with it the roots of two anterior motor and two posterior sensory nerves. Many, therefore, are the channels by which the activity excited in the nerve-cell by the stimulus of the efferent nerve may be discharged: it may be at once reflected on an efferent nerve, and through it discharge one or other of the functions which we have previously described; or it may pass to other interconnected cells, and, acting thus upon a system of nerves, produce associated movements, either such as proceed from the cord nearly on the same level as the afferent nerve enters, or from a different level; or, lastly, it may pass upwards, and excite the higher functionally co-ordinated centres.

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* Or take the bee as an illustration. If its head be suddenly cut off, and honey applied to its proboscis, sucking movements are made, showing that the co-ordinating centres for these movements are in the head segment. The body, when separated from the head, makes movements as if for collecting pollen, and if it be placed upon its back, it gets on to its feet again; the centres for these movements being in the thoracic segment. If the abdomen be cut off, it is found that the centre for stinging movements is in this segment. *Reichert and Du Bois' Archiv.* H. 1. 47, 1875.

To Pflüger belongs the merit of having first attempted to systematise the laws of the reflex movements. They are :—1. *The law of simultaneous conduction for one-sided reflex movements.* When a reflex movement takes place on one side of the body only, in answer to a stimulus, it is always on that side of the body on which the irritation of the afferent nerve operates; the reason being probably that the motor nerves proceed from ganglionic cells which are in direct connection with the stimulated afferent nerves.—2. *The law of symmetry of reflex action.* When a stimulus has produced reflex movements on one side, and its continuance or its further extension in the spinal cord produces movements of the opposite side, then the corresponding muscles only of this side are affected. This is owing, no doubt, to the commissural system, which connects together the corresponding ganglionic cells of the two halves of the cord.—3. *The unequally intense reflex action of the two sides* in the event of both being affected. When the reflex action is stronger on one side than upon the other, the stronger movements take place upon the side of the irritation.—4. *The law of irradiation of reflex action*, by which an extension of reflex action takes place from the nerves in which it first appears to neighbouring ones, owing to the communications between the different systems or groups of ganglionic cells. When the excitation of an afferent *cerebral* nerve is transferred to motor nerves, it is observed that the roots of both sorts of nerves are placed nearly upon the same level in the central organ, or that the motor nerve lies a little behind or below, never in front of or above, the afferent nerve. If the reflex action spreads further, the way of irradiation is *downwards* to the medulla oblongata; stimulation of the optic nerve, for instance, produces contraction of the iris. In the spinal cord the primarily affected motor nerve lies nearly on the level of the stimulated sensory nerve. But if the reflex action spreads, then it passes *upwards* towards the medulla. When the irritation has arrived at the medulla, then it may pass downwards again.—5. The reflex action produced by the irritation of a sensory nerve can only appear in three places, whether one-sided or occurring on both sides of the body. (*a*) It appears in the motor nerves which lie nearly on the same level with the excited sensory nerve. (*b*) If reflex action implicates the motor nerves on a different level, these motor nerves are constantly such as spring from the medulla oblongata: tetanus and hysterical convulsions in consequence of local irritations furnish examples. (*c*) The reflex action affects the muscles of the body generally; the principal focus of irradiation thereof being the medulla oblongata.

I go on next to indicate briefly the causes which affect the functional activity of the spinal cord; the interest of the study lying in the fact that similar causes affect the functions of the higher nerve centres, and are the morbid conditions of the various phenomena of mental disorders:—

1. As an original fact, the ganglionic cells may have a greater or less stability of composition. It sometimes happens that a child is born with so great an instability of nerve element, that the most violent convulsions ensue on the occasion of very slight irritation. Or the evil may be less serious, and the individual may be equal to the ordinary emergencies of a quiet, favourably spent life; but there is an absence of that reserve power necessary to meet the extraordinary emergencies and unusual strain of adverse events. When, therefore, an unaccustomed stress is laid upon the feeble nerve element, it is unequal to the demand made upon it, and

breaks down into a rapid degeneration. This innate feebleness is evinced by an excessive irritability; it is truly an irritable weakness; and its most common cause is an unfortunate inheritance, the curse of a bad descent. Any sort of disease of the nervous system in the parents seems to predispose more or less to this ill condition of the child; the acquired deterioration of the parent becoming the inborn organic feebleness of the offspring.

The degeneration of nerve element in the ganglionic cells reveals itself in a disturbance of the co-ordinate or aim-working activity which, as we have already seen, marks the highest development of its function. Convulsions are the sure signs of a weakness or lowered vitality of nerve element,—a defect which, though we cannot yet ascertain its exact nature, certainly implies an unstable equilibrium of its organic constitution. Each central nerve-cell exists in close relations, physical and physiological, with other nerve-cells; when, regardless of these relations, it reacts directly outwards on its own account, it is very much like an individual in a social system who, by reason of madness, or of a criminal disposition, rejects the restraint of social relations and breaks out in mischievous anti-social activity.

Not only may an excess of irritability be a defect in the nature of the ganglionic cell, but this may be defective also by reason of a great insensibility of nature and a want of power of assimilation. In congenital idiots the central cells of the cord do plainly sometimes partake of the degeneracy of the brain, and are idiotic also; they are incapable of receiving impressions with any vividness, and of retaining the traces or residua of such as they do receive—incapable of education. Spasms of the limbs, sometimes limited to the toe, to one arm or leg, at other times more general; contractions of a foot, or of the knees to such degree as to make the heels touch the buttocks; more frequent still, paralytic conditions of varying degree and extent, and atrophied limbs, now and then indulging in convulsive movement —all these morbid states are met with in idiots, and, though in part attributable to the brain, are certainly in part due to degeneration of a spinal cord utterly oblivious of its design or final purpose in the universe. In some cases where the morbid degeneration is not so extreme, it is not impossible to teach such combinations of movements as are necessary for the common work of life. It may be observed incidentally that the ease and rapidity with which those idiots who have by perseverance been taught difficult feats of action perform them, and the machine-like exactness of their movements, display well the important functions of the spinal cord as an independent nerve centre; for they display its functions in a case in which the influence of the cerebral hemispheres is sometimes almost excluded.

2. The functional action of the spinal ganglionic cells may suffer from the too powerful or prolonged action of an external stimulus, or from an activity continued without due interval of rest. The molecular degeneration or waste, which is the condition of functional activity, must be repaired by rest and nutrition; the nerve-cell is no inexhaustible fountain of force, but must take in from one quarter what it gives out in another; and if due time be not allowed and proper material be not supplied for the development of its highly vital structure by assimilation of matter of a lower quality, it is certain that, notwithstanding the best innate constitution, deterioration must ensue as surely as a fuelless fire must go out. In that degeneration of the spinal cord which sometimes occurs in consequence of sexual vice or excess, one of the first symptoms is a loss of co-ordinating power over the motions of the legs—a loss, in other words, of that which is the last organized faculty of the spinal centres. The startings of the limbs and the partial contractions of

certain muscles which may follow do not evince increased power, as some have heedlessly fancied, but are the indications of lowered vitality; they are the incoherent manifestations of a degenerate instability of nerve element. When such a morbid condition of things is brought about, there is necessarily a failure in the power of the ganglionic cells to receive and assimilate impressions: hence it is that in general paralytics, in whom the memory of each independent nervous centre is decayed, there is not only an inability to accomplish successfully the actions to which they have been accustomed—as, for example, an inability of a musician, whom from his conversation one would deem quite capable of his work, to perform on his accustomed instrument; but there is also the impossibility of teaching them new combinations of movements. In other sorts of lunatics this is often possible: though mentally much degenerate, and actually lost for ever to the world, they may by persevering training be made useful in certain simple relations to which they grow and react as automatic machines, their own cerebral hemispheres not interfering; the general paralytics, in whom the disease has advanced so far as to affect the spinal cord, cannot thus be utilized.

3. The supply of blood and the condition of it are manifestly of the greatest consequence to the welfare of the spinal cells. The grey matter of the cord is very richly supplied with capillaries, to the end that there may be a quick renewal of blood ministering to the active interchange that goes on between the ganglionic cell and the nutrient fluid; the enormous consumption of force in nervous function demanding such an abundance of supply. What Mr. Bain describes as the *spontaneous* energy of nerve centres, and lays so much stress on as the foundation of volition, is probably the result of the state of the blood in them—either of its compostion or of its distribution. We know at any rate that the

movements of inspiration are provoked by an excess of carbonic acid in the blood circulating through the medulla oblongata and the spinal cord. How many modifications of nutrition, of secretion, and of the distribution of blood in the different organs, of which we can give no account, may be due to the character or the distribution of the blood circulating in the spinal cord! When the supply of blood is suddenly cut off, as in the well-known experiments of Stannius, Brown-Séquard, and Schiff, the nervous activity is presently paralysed, and rigor mortis of the muscles ensues. When the supply of blood is soon restored to a part in which rigor mortis has taken place, as in Brown-Séquard's experiment of injecting warm blood into the stiffened arm of an executed criminal, the muscles presently regain their contractility, and the nerves their irritability. As a complete cutting-off of the blood is paralysis of nerve element, so a deficiency of blood, or of material in it fitted for the nutrition of nerve, is to the extent of its existence a cause of degeneration or instability of nerve element. Such deterioration is exhibited by cachectic and anæmic persons in a great irritability, and in a disposition to spasms or convulsions—an acquired condition not unlike that which is sometimes inherited.

The state of the blood may be vitiated by reason of the presence of some foreign matter which, whether bred in it or introduced from without, acts injuriously or as a direct poison on the individual nerve-cells. Strychnia notably so affects them that, on the occasion of the slightest stimulus, they react in convulsive activity; while the curare poison, on the other hand, produces a sort of stupor or coma, and paralyses all activity. Curiously enough the methyl derivatives of strychnia, the iodide of methyl-strychnium and the sulphate of methyl-strychnium, according to the observations of Drs. Frazer and Crum Brown, produce exactly the same symptoms as the curare; showing that a slight difference in the chemical composition of a substance may occasion a great difference in its physiological effects. Moreover, if a sufficiently large quantity of strychnia be introduced under the skin of a frog, the effects may closely resemble those produced by the curare; death taking place without any, or with only very feeble, convulsions. Opium, which usually produces coma in man, produces convulsions in frogs, and sometimes in children. We might, were it needful, accept these different effects of poisons, which are alike positively injurious to the integrity of nerve element, as evidence that convulsions do not mean strength: they are not the result of an increase in the proper vital activity of parts; on the contrary, they evince degenerate function and are the forerunners of paralysis. The various vegetable poisons indicate also, by their different effects upon the same and upon different structures, the fine differences of composition in the ganglionic centres of the central nervous system; in this way they throw some light as chemical reagents upon the nature of physiological functions, and they are the most sensitive reagents in this regard which we yet possess.

There is reason to believe that the presence of too much blood in the spinal cord may be as baneful as an insufficient supply. All the symptoms of disorder of nerve element which accompany anæmia may certainly be produced also by congestion or congestive hyperæmia; the proper nutritive interchanges, the supply of suitable nutrient products and the removal of effete products, being as much impeded or checked by stagnation as by deficient supply of blood. The blood-vessels are furnished with vaso-motor nerves which regulate their calibre and therefore the amount of the supply of blood, and these nerves are more or less plainly under the control of spinal centres. It is obvious that an undue contraction or dilatation of the vessels may affect temporarily the function, or permanently the nutrition, of the nerve centres, and so occasion morbid phenomena.

4. The existence of a persistent cause of eccentric irritation, whether the result of injury or disease in some part of the body, may give rise to a morbid state of the spinal nerve-cells by a so-called *sympathetic* or *reflex* action. This may be considered a pathological application of physiological function which is in constant operation. Volkmann has observed movements to be produced in the limbs of a decapitated frog by stimulation of the intestinal canal; the results being much more evident if the animal has previously been poisoned with strychnia. In a well-known experiment by Goltz a sharp tapping upon the abdomen of a frog produces a sudden arrest of the heart's action; and it has been recently shown by Tarchanoff that when a loop of the intestine with its corresponding piece of mesentery is pulled out of the abdomen of a frog, and exposed to the air for a few hours until it becomes inflamed, the slightest touch of the inflamed loop will suffice to produce a stoppage of the heart's action within from a few seconds to half a minute.* The stimulus is carried to the medulla oblongata, there reflected upon the vagus nerve, and operates through it upon the ganglia of the heart; for the effect does not take place if conduction be arrested by section of the vagus or by poisoning with curare. The convulsions which sometimes take place during teething in children, owing to the presence of worms in the intestines, are familiar examples of sympathetic or reflex effect upon a susceptible growing nervous system. It is necessary to distinguish two kinds of effects of this reflex action—or, perhaps, different degrees of the same kind of effect—namely, a reflex functional modification and a reflex nutritive modification.

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* *Archiv de Physiologie*, 1875, p. 408.

The irritation of a decayed tooth may, as is well known, give rise to a contraction of the muscles of one side of the neck, or to a violent facial neuralgia, or to blindness or deafness, all which presently disappear upon the removal of the cause of the mischief. A functional derangement only has existed so far. But the irritation of a bad tooth produces a greater and more lasting effect, when, as does now and then happen, an abscess in the glands of the neck takes place in consequence of it, and remains an incurable fistula until the removal of the scarce suspected cause. The nutritive derangement has been caused and kept up by the reflex irritation. It must certainly be allowed that the functional disorder, when it alone seems to exist, does testify to some kind of change in the molecular relations of the ganglionic cells; but as the abnormal modification vanishes the moment the real cause of mischief, the bad tooth, is gone, it is scarcely possible to view the disturbed function as evidence of any serious chemical or organic derangement in the nerve-cells. With the continuance of the cause of irritation, the functional disorder undoubtedly may, and is liable to, pass into disorder of nutrition. The relations of these different degrees or kinds of derangement to the morbid cause are such that we might not unfairly represent the sole existing functional derangement as due to a modification of the polar molecules of the nerve element, while the abnormal nutrition may be supposed to mark an actual chemical change in its constitution.

Again, as the spinal centres minister both to our animal life and to our organic life, they necessarily have, in the former case, a periodical function; in the latter case, a continuous function. When, therefore, a morbid condition of the ganglionic cells subserving animal life exists, the functional derangement will probably be not continuous but intermittent. Intermittence of symptoms is indeed a common, almost a constant, feature of nervous disease, and I know not why we should be surprised thereat, if we reflect that alternation of rest and activity is the law of the nervous functions of animal life. Thus, in epilepsy, it appears as if the reacting centres must be gradually charged until they reach a certain tension or instability, when the statical equilibrium is destroyed, and they discharge themselves violently. Something of the same kind takes place in the poisonous action of strychnia: a dog so poisoned will fall down in convulsions, but, according to Schroeder van der Kolk, they cease after a time, and the animal seems to be perfectly well; even for so long as an hour it may be touched or stroked without harm; after which the susceptibility again becomes so great that by simply blowing upon the skin convulsions are reproduced. The molecular explosions in the intimate elements of nerve tissue produce molecular exhaustion; and when the energy of the parts is restored by respite and repair, the morbid instability is restored, so long at any rate as the morbid conditions remain. If the dog can be kept alive until the strychnia is eliminated by the secretion, then the restoration of energy will be the gradual restoration of a stable equilibrium of molecules; the convulsions will become less and less violent and finally cease; and the animal will recover.

When, on the other hand, the function of the spinal centres ministering to the organic life is deranged, the morbid effect will most likely be continuous. The experiments of Lister, showing that the movements of the granules in the pigment cells of the frog's skin are under the control of the spinal system, and the investigations of Bernard and others, agree to prove that the cerebro-spinal axis may not only control the contractions of the small arteries, but that it directly influences the organic elements engaged in nutrition and secretion. The moment food is introduced into the mouth there is a flow of saliva and of gastric juice.

Numerous examples have been of old quoted of distant modifications of nutrition in consequence of some irritation of a centripetal nerve: a large secretion of extremely acid gastric juice has been cured by the extirpation of painful piles; ptyalism is produced sometimes, as lachrymation frequently is, by neuralgia of the fifth nerve; irritation of the uterus, or of the skin of the breasts, or of the mucous membrane of the vagina, has been known to give rise to the secretion of milk; and menstruation may follow irritation of the ovaries, or the application of warm poultices to the breasts. We witness phenomena due to this reflex nutritive action again in the sympathy which one eye so often exhibits with disease of the other; in the congestion of the eye or the actual amaurosis which sometimes accompanies severe neuralgia; in the paraplegia due to displacement or disease of the uterus; and in many other instances too numerous to be mentioned. Pflüger quotes from Dieffenbach a striking case, which admirably illustrates the effects of an eccentric irritation upon the spinal cord. A young girl fell upon a wine-glass, and cut one hand with a piece of the broken glass; for years afterwards she suffered from violent neuralgic pains and emaciation, with contraction and complete uselessness of the hand; she was afflicted also with severe attacks of epilepsy. On cutting through the cicatrix of the old wound, a minute splinter of glass, which had wounded the nerve, was detected; the nerve was also thickened and hardened. After removal of the glass, the neuralgia and epilepsy disappeared, and the girl recovered the entire use of her hand. These instances of morbid reflex function prove how complete is the unity of the bodily life, and how important and far-reaching may be, through the agency of the unifying nervous system, the effects of disorder of what seems a trivial part. In truth, we can call nothing trivial in the marvellous consensus of energies which a living organism is; and a prudent man will deem it a sacred duty to keep holy, *i.e.* healthy, the temple of his body.*

5. Lastly, the severance of the connection between the brain and the ganglionic cells of the spinal cord seems in some degree to affect their function. When a nerve is cut across in the living body, the peripheral end soon undergoes fatty degeneration, while the central end remains unchanged after years; and this degeneration is not owing solely to the inactivity of the nerve, for it still takes place when the nerve is regularly stimulated, and takes place much less quickly in frogs and cold-blooded animals, in which nutrition is sluggish, than in warm-blooded animals, in which it is active. It is perhaps a fair conclusion that the nerve fibres have their nutrition subjected in some measure to the nerve centres; that these play in relation to them the part of nutritive centres. After apoplexy in or about the corpus striatum, Turck professes to have found granular cells in the course of the fibres as they pass downwards, so that such cells were met with in the spinal cord on the opposite side to the seat of disease. It is known, too, that the removal of the brain in the lower animals increases the ease with which reflex movements take place; and there are many cases on record in which the reflex action has been increased in man when disease or injury has interrupted the continuity of the spinal centres with the brain. May we not, then, conclude from such facts that a positive nutritive influence is exercised by the brain upon the ganglionic cells of the cord and upon the nerve fibres which proceed from the cerebro-spinal axis, as well

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* It is known that a small cause of irritation may cause tetanus. Dr. Taylor (*Medical Jurisprudence*) mentions a fatal case of tetanus, which was at first thought to be idiopathic, but which was found to have been really caused by a small splinter of wood that had penetrated the thumb. And Dr. G. Johnson has recorded a case of tetanus which was cured by the removal of a small piece of the fibre of cloth from the scar of an old wound.

as by the spinal centres on the nerve fibres which proceed directly from them and upon the subordinate ganglia? In fact, may we not justly conclude that this influence, which was expressed by old writers as the secretion of the vital spirits by the brain, is exerted by every nerve centre on the centre which is subordinate to it,* and on the nerves which proceed from it; and that the inhibitory action which a higher nerve centre is observed to have upon the function of a lower centre may be really an instance of its exercise? The inference would be agreeable to what we know of the direct functional action of the brain upon that of the cord; the reflex acts in health being for the most part notably subordinate to the control of the will. As a guiding influence passes from above downwards when the cerebro-spinal system is ministering to the functions of animal life, so it is not improbable that the brain, in the accomplishment of its function as an organ of organic life, exerts some power which is favourable to the nutrition of the parts which lie below it, and which are the instruments through which it acts. This influence being withdrawn, an exaggeration of the excitability of the cord occurs, such as a wound causing tetanus may produce, or such as was produced by Brown-Séquard in guinea-pigs, when, having injured their spinal cord two or three weeks before, he was able to excite epileptiform convulsions at will by pinching the skin over a certain area of the face. It is true that some have thought to explain in another way the increase in the reflex movements which follows the severance of connection between the brain and cord;

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* "As the brain secretes the vital spirits, and as in animals endowed with brain it is requisite that the nerves be supplied with these, as the medium for the transmission of impressions, the brain must be considered as being necessary, at least, to the *continued* production of nerve-actions; unless the animal be so constituted that the vital spirits are secreted in the medulla of the nerves, or in their ganglia, as in avertebrate animals."—UNZER (*op. cit.*), p. 225

they have attributed it to the augmented energy of the spinal centres, and to the concentration of the stimulus, now that a path for the dispersion of its force is cut off. Such theory is hardly innocent of the vulgar error of regarding as increased energy that which is truly a diminution or deterioration of the higher vital energy of the part. The co-ordinate reflex acts which take place in answer to the natural tactile impressions are not made more energetic or effective by cutting off the influence of the brain; only the irregular reflex movements that follow chemical, electrical, or strong mechanical stimuli are increased. One most important function of the brain is to exert an inhibitory power over the nerve centres that lie below it, just as man exercises a beneficial control over his fellow animals of a lower order of dignity; and the increased irregular activity of the lower centres that have escaped from control betokens degeneration: it is like the turbulent, aimless action of a democracy without a head.

Such, then, are the disturbing causes which may affect the activity of the spinal cord, both as a conducting path and as an independent centre of the generation of nerve-force. When we reflect upon the great proportion of the daily actions of life that are effected by its unconscious agency, we cannot fail to perceive how important is the due preservation of its integrity. No culture of the mind, however careful, no effort of the will, however strong, will avail to prevent irregular and convulsive action when a certain degree of instability of nerve element has, from one cause or another, been produced in the spinal cells. It would be as absurd to preach control to the spasms of chorea, or restraint to the convulsions of epilepsy, as to preach moderation to the east wind, or gentleness to the hurricane. That which in such case has its foundation in a definite physical cause must have its cure in the production of a definite physical change.

So certain and intimate is the sympathy between the individual nerve-cells in that well-organized commonwealth which the nervous system represents, that a local disturbance is soon felt more or less distinctly throughout the whole state. When any serious degeneration of the ganglionic cells of the cord exists, there is not only an indisposition or inability to carry out as subordinate agents the commands which come from above; but there is a complaint sent upwards—a moan of discontent or pain reaches the supreme authority. That is the meaning of the feelings of weariness, heaviness, achings of the limbs, and utter lassitude which accompany disorder of the spinal centres; and the convulsive spasms and the local contractions or paralysis of muscles are the first signs of a coming rebellion. If the warnings do not receive timely heed, a riot may easily become a rebellion; for when organic processes, which normally go on without consciousness, force themselves into consciousness, it is the certain mark of a vital degeneration. If the appeal is made in vain, then further degeneration ensues. Not only is there irregular revolutionary action of a subordinate, but there is *pro tanto* a weakening of the supreme authority; it is less able to control what is more difficult of control. When due subordination of parts exists, and the individual cell conforms to the laws of the system, then the authority of the head is strengthened. A foolish despot, forgetting in the pride of his power that the strength and worth of a government flow from and rest upon the well-being of the governed, may fancy that he can safely disregard the cry of the suffering and the oppressed; but when he closes his ears to complaints, he closes his eyes to consequences, and finally wakes up to find his power slipped from him, and himself entered upon the way of destruction. So is it with the nervous system: the cells are the individuals, and, as in the state, so here, there are individuals of higher dignity and of lower dignity; but the well-being and power of the higher individuals are entirely dependent upon the well-being and contentment of the humbler workers in the spinal cord, which do so great a part of the daily work of life. The form of government is that of a constitutional monarchy, in which every interest is duly represented through adequate channels, and in which, consequently, there is a proper subordination as well as co-ordination of parts.

I have lingered thus long upon the spinal cord, because most of what has been said concerning its functions may, with the necessary change of terms, be applied to the higher nervous centres. A distinct conception of the nature and mode of development of the functions of the spinal centres is the best, is indeed the only adequate, preparation for an entrance upon the study of cerebral function; it is an indispensable prerequisite to the right understanding of the higher displays of nervous function, and alone fixes the sure basis whereon to build a true mental science.* In this way we apply the laws generalised from the more simple cases to disentangle the phenomena of the more complex cases. Any system not so founded follows not the order of development in nature, and must be unstable and insecure: Nature herself protests against it with energetic eloquence when she makes, as she unquestionably sometimes does, morbid action of the cells of the cerebral hemispheres vicarious of the morbid action of the spinal cells.

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* In the *Archiv. für Physiolog. Heilkunde*, 1843, there is an excellent paper by Prof. Griesinger, "Ueber psychische Reflexactionen, mit einem Blick auf das Wesen der psychischen Krankheiten;" and another in the same Journal for 1854, "Neue Beiträge zur Physiologie und Pathologie des Gehirns."

In the *Journal of Mental Science* (January 1876) is an historical and critical paper by Dr. Laycock, entitled "Reflex, Automatic, and Unconscious Cerebration," in which he gives a full and detailed account of the first promulgation by himself, in this country, of the doctrine of the reflex action of the brain, and of its subsequent development. It appears from this paper that he first broached the doctrine in 1840, in his "Treatise on the Nervous Diseases of Women," although he did not fully expound it until he read a paper "On the Reflex Function of the Brain" before the British Medical Association in 1844. The paper was afterwards published in the *British and Foreign Medical Review*, January 1845.

NOTES.

[1] (*p.* 139).—Pflüger compares the movements of a decapitated animal with those of a sleeping man, deeming the movements in both to be conscious. He tickled the right nostril of a sleeping boy, and the lad rubbed it with his right hand: when Pflüger tickled the left nostril the lad rubbed it with his left hand. If he held the sleeper's right hand without waking him, and tickled his right nostril, the boy first made attempts with his right hand to rub it, but when this did not succeed, and the irritation continued, he then made use of the left hand.

"Crickets allure to sexual congress after decapitation by the vibration of their wings; and Redi, Bibiena, and others, have observed that butterflies, after having copulated but once in their lives, repeat the function repeatedly when decapitated, and the females, after sexual congress, deposit their eggs as carefully as if excited thereto by their instinct." UNZER.—*On the New System*, Syd. Soc. Trans. p. 287. Thus the fluttering of the wings of the female butterfly excites the sexual organs of the male, but only when the route has been laid down by an accomplished sexual act; for no such effect is produced unless sexual congress has taken place at least once before decapitation. On the first occasion a sensory stimulus must co-operate with the purely reflex stimulus; the latter suffices afterwards.

The following quotation is from Spinoza, as translated by M. Saisset:—"Personne, en effet, n'a déterminé encore ce dont le corps est capable; en d'autres termes, personne n'a encore appris de l'expérience ce que le corps peut faire et ce qu'il ne peut pas faire, par les seules lois de la nature corporelle et sans recevoir de l'âme aucune détermination." "This is not astonishing," he adds, "as no one has sufficiently studied the functions of the body," and instances the marvellous acts of animals and somnambulists—"toutes choses qui montrent assez que le corps humain, par les seules lois de la nature, est capable d'une foule d'opérations qui sont pour l'âme jointe à ce corps un objet d'étonnement. . . . . J'ajoute enfin que le mécanisme du corps humain est fait avec un art qui surpasse infiniment l'industrie humaine." The associating link of many movements—as, for example, of those of the heart, of the eye, of breathing—plainly exists in the conformation of the nervous centres; the wisdom or design is exhibited in the primary arrangement, whereby the reactions of the organism necessarily following do, *as a rule*, minister to the furtherance of its well-being.

[2] (*p.* 149).—"And therefore it was a good answer," said Bacon, "that was made by one, who, when they showed him, hanging in a temple, a picture of those who had paid their vows as having escaped shipwreck, and would have him say whether he did not now acknowledge the power of the gods, 'Ay,' asks he again, 'but where are they painted that were drowned after their vows?'" Speaking of final causes, upon which the human understanding falls back, he says that they "have clearly relation to the nature of man rather than to the nature of the universe; and from this source have strangely defiled philosophy."—*Nov. Org.* Aphorism xlvi.

To the same effect Spinoza wrote :—"But we are not to overlook the fact, that they who advocate this doctrine, and who have desired to find scope for the display of their ingenuity in assigning causes, have had recourse to a new style of argument to help them in their conclusions, namely, by reduction not to the impossible or absurd, but to ignorance or the unknown; a procedure which shows very plainly that there was no other course open to them. If, for instance, a stone or tile fell from a house-top on the head of any one and killed him, they demonstrated in their way that the stone or tile fell to the end that the man might be killed. For if not to this end, and the special will of God, how should so many concurring circumstances (and very many circumstances do often concur in such a case) have led to the event? You will reply, perhaps, that the event happened because of the rough wind, the loose tile, and the presence of the man on the spot. But they will then urge : wherefore blew the wind so rudely? Why was the man at the particular instant on the very spot on which the tile must fall? If you answer, that the wind blew because of the neighbouring tempest, whose approach was indicated by the heaving of the sea on the preceding day, though the weather was then fine, and because the man had been invited, and was on his way to the house of a friend, they will still go on to ask—for in such a case there is no end of asking—why the tempest arose at a distance on the day before, and why the man was invited at that particular time,—the cause of a new cause inquired for in endless sequence, until shelter is sought in what in such a case is called the Will of God, the asylum of ignorance. So also when they regard the structure of the human body they are amazed; and because they are ignorant of the cause of so much art, they conclude that it has been contrived and put together by no mechanical, but by some divine or supernatural art, in such wise that each part in serving its own purpose is not injurious to another. And thus it comes that he who inquires into the true causes of miracles and prodigies, and who admires the harmony of natural things as a person of knowledge and understanding, and not as a simpleton, is everywhere proclaimed an infidel and impious person, and is so regarded by those whom the vulgar bow before as the interpreters of nature and the Divine decrees. For these men know that with ignorance removed wonder ceases, and the only means they have of enforcing their dicta and preserving their authority comes to an end."

[3] (*p.* 150).—"After the actions which are most perfectly voluntary have been rendered so by one set of associations, they may, by another, be made to depend upon the most diminutive sensations, ideas, and motions, such as the mind scarce regards, or is conscious of; and which, therefore, it can scarce recollect the moment after the action is over. Hence it follows that association not only converts automatic actions into voluntary, but voluntary ones into automatic. For these actions, of which the mind is scarce conscious, and which follow mechanically, as it were, some precedent diminutive sensation, idea, or motion, and without any effort of the mind, are rather to be ascribed to the body than the mind, *i.e.* are to be referred to the head of automatic motions. I shall call them automatic motions of the secondary kind, to distinguish them both from those which are originally automatic, and from the voluntary ones; and shall now give a few instances of this double transmutation of motions, viz. of automatic into voluntary, and of voluntary into automatic." He instances the manner in which children learn, and especially the way we learn to speak, to play on the harpsichord, &c. "The doctrine of vibrations explains all the original automatic motions; that of association the voluntary and secondarily automatic ones."—HARTLEY'S *Theory of the Human Mind*, edited by Priestley, pp. 31, 37. 1795.

Unzer clearly recognised the nature of the acquired automatic acts:—"And, on the contrary, we seek at first to avoid many pains and other unpleasant external sensations by voluntary movements, which afterwards become purely automatic, as, for example, shouting, writhing and retracting when in pain; the quickened walk and the drawing up the legs to the body in severe cold; the contraction of the eyelids in a strong light, and a thousand other movements, the objects of instincts, formerly volitional, but become mechanical from frequent repetition. Neither can we infer that the sentient actions of an instinct, which in us or in another animal are volitional movements, must have been such formerly, or will be for the future, or are such in any other creature."—*Op. cit.*, p. 152.

[4] (*p.* 160).—"Impressionum sensoriarum in motorias reflexio, quæ in sensorio communi fit, non peragitur juxta solas leges physicas, ubi angulus reflexionis æqualis est angulo incidentiæ, et ubi, quanta fit actio, tanta etiam sequitur reactio; sed leges peculiares, a naturâ in pulpam medullarem sensorii quasi scriptas, sequitur ista reflexio quas ex solis effectibus tantum noscere, neutiquam vero assequi nostro ingenio valemus. Generalis tamen lex, quâ commune sensorium impressiones sensorias in motorias reflectit, est nostri conservatio: ita ut impressiones externas corpore nostro noscituras sequantur certæ impressiones motoriæ, motus producturæ eo collimantes, ut monumentum a corpore nostro arceatur, amoveaturque; et vice versâ impressiones externas seu sensorias, nobis profuturas, sequantur impressiones internæ seu motoriæ, motus producturæ eo tendentes, ut gratus ille status ultra conservetur."—PROCHASKA, *op. cit.* p. 88.

Unzer had upheld the same doctrine, describing the effects respectively as *connatural* and *contranatural* (naturlich und widernaturlich), according as they are in accordance with the well-being of the organism or not.

CHAPTER IV.

SECONDARY NERVOUS CENTRES, OR SENSORY GANGLIA; SENSORIUM COMMUNE.

THE different collections of grey matter in the medulla oblongata, and at the base of the brain, consist chiefly of the nervous centres of the senses with corresponding centres of motor reaction. They are really continuations of the grey substance of the spinal cord, from which they are differentiated by more specialised functions. Continuing the grey substance as high as the floor of the lateral ventricles, they include the optic thalami, the corpora striata, the corpora quadrigemina, and the different sensory centres that are placed in the medulla oblongata, the tuber annulare, and the cerebral peduncles. The olfactory bulbs, which lie at the base of the anterior cerebral lobes, must also be included in the sensorium commune. Any one of the senses may be destroyed by injury to its sensory ganglion as surely as by actual destruction of its organ; blindness is produced by injury to the corpora quadrigemina, smell is abolished by destruction of the olfactory bulbs. These ganglionic centres are thus intermediate between the hemispherical ganglia above and the spinal centres below; to those they are subordinate, to these they are superordinate. In many of the lower animals, as already pointed out, the brain consists of nothing more than the sensory ganglia, with centres of motor reaction; there are no superimposed cerebral ganglia.

It is not the place here to enter into a discussion of the different opinions which have been entertained concerning the exact centres of the different senses; much of what is said on these difficult questions being still conjectural. It has for some time been supposed that the seat of common sensation is in the thalami optici, because it is in these bodies that the posterior or sensory columns of the spinal cord seem to terminate; and that the corpora striata, to which the anterior or motor columns of the cord pass, are the corresponding motor centres. Vulpian, however, has brought forward strong arguments in favour of assigning the seat of common sensation to the tuber annulare. After the removal of the corpora striata, the tubercula quadrigemina, and the cerebellum —the tuber annulare and the medulla oblongata being the only parts of the encephalon left—he found that dogs and rabbits evinced, by violent agitation and decided cries of suffering, the pain felt when severely pinched or otherwise irritated. Moreover, injuries of the thalami optici, pathological or experimental, do not weaken sensibility, but do often produce motor paralysis. He concludes that we are yet in entire ignorance of the special functions both of the thalami optici and the corpora striata. Notwithstanding this opinion, those who have examined the arguments on this subject will probably conclude that Vulpian's theory concerning the tuber annulare has blinded him to the import of the evidence in favour of the thalami optici and the corpora striata as sensory and motor centres respectively. It may well be that they are not the entire centres, and that there are other centres of sensibility and motion in the tuber annulare and cerebral peduncles; but that they do minister to those functions it is hardly possible to doubt. Luys looks upon the thalami optici as a kind of sensorium commune in which all sensations meet. But it is not by any means certain that all the sensory nerves go to them, some of these nerves apparently going directly to the cortex of the hemispheres, while it is tolerably certain that some motor nerves are connected with them. Wundt makes the conjecture that they are centres of reflex functions in which the impressions of touch are received and transformed into corresponding movements. That destruction of them is not followed by loss of sensibility of the skin may be owing to the fact that some sensory fibres ascend beneath them directly to the hemispheres. He looks upon the chief portion of the corpora striata as a motor centre through which the impulses of the will coming downwards from the cerebral hemispheres act upon the motor nerves; the remaining small portion at their base being a centre in which the central olfactory fibres and certain motor fibres terminate.* Meanwhile all that concerns us here, in dealing with the cerebral functions from a psychological point of view, is to have some general term to embrace and designate all the centres of sensation; and for this purpose I shall employ the term *sensorium commune*, using it as a generic term to denote the common centres of sensation, and not, as Vulpian and some others have misused it, as a special term to designate the centres of common sensation. In a similar psychological sense I shall subsequently use the terms *motorium commune* and *intellectorium commune*.

The ganglionic centres of the sensorium commune are formed of numerous nerve-cells, which, like those of the spinal cord, are in connection with afferent and efferent nerves; the afferent nerves in this case coming mostly from the organs of the special senses. The impressions which the afferent nerves bring are, therefore, special in kind, as also are the grey nuclei to which they are brought; a progressive differentiation of structure and function is manifest; and we might describe the sensorium commune, physiologically, as a spinal cord, the afferent nerves of which are the nerves of the special senses, or rather of the various kinds of sensibility. For although we usually distinguish only between the special senses and general sensibility, yet there are really different kinds of the latter, each perhaps having its special nucleus: the tactile sense, the sense of temperature, the muscular sense, differ not in degree only, but in kind. An exact knowledge of the anatomical relations of the different grey nuclei is still wanting, notwithstanding the patient investigations of many inquirers. All that we are certain of is, that the fibres of the nerves are connected with the cells, as may be most easily seen in the case of the auditory nerve and ganglion; that manifold connections exist between different nuclei; and that fibres may sometimes be traced from the nucleus of a sensory nerve to a motor nerve upon which it is known to exert a reflex action. The trigeminus, or fifth nerve, for example, passes from above downwards through the medulla, and in its downward course forms reflex connections with all the motor nerves of the medulla as it reaches the level of their nuclei; in this way the facial, the glossopharyngeal, the vagus, the spinal accessory, and the hypoglossal nerves receive communications from it. The ganglionic cells of different nuclei also differ in form and size; and Schroeder van der Kolk held that, as a general rule, at every spot where fibres are given off for the performance of any special function, there fresh groups of ganglionic cells giving origin to them appear.

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* *Grundzüge der Physiologischen Psychologie*, p. 198.

We justly conclude, then, that, as we should *à priori* expect, special ganglionic centres minister to special functions; that the central cells are, as it were, the workshops in which, on the occasion of a suitable stimulus, the peculiar current necessary for the performance of the specific action is excited. A message is sent up to them by the appointed channels, and they reply by sending through the regular motor channels the particular energies which it is their function to supply. Charged with their proper force during the assimilating process of nutrition, it exists in them in a potential or latent form; and the condition of unstable vital equilibrium is upset, the force being then discharged, as the Leyden jar is, when a certain stimulus meets with a sufficient tension.

The natural course of a stimulus, all the force of which is not reflected upon an efferent nerve in the spinal centres, is upwards to the sensorium commune, where it becomes the occasion of a new order of phenomena; the law of extension of reflex action excited by a spinal nerve observably being, as Pflüger has shown, from below upwards to the medulla. Having arrived at the ganglionic cells of the sensorium commune, the stimulus may be at once reflected through the motor nuclei on a motor nerve, for which there is provision in a direct physical path, and involuntary movements may thus take place in answer to a sensation, just as involuntary movements take place from the spinal centres without any sensation. The ganglionic cells of the sensory centres are unquestionably centres of independent reaction, and, in association with their proper motor nuclei, give rise to a class of reflex movements of their own. When a man lies with the lower half of his body paralysed in consequence of injury or disease of his spinal cord, the tickling of the soles of his feet will sometimes produce reflex movements of which he is unconscious. When a man lies with no paralysis of his limbs, but with a perfectly sound spinal cord, the sudden application of a hot iron to his foot or leg will give rise to a movement quite as involuntary as that which takes place in the paralysed limb, but, in this case, in answer to a painful sensation; the reaction takes place in the sensory ganglia, is accompanied by feeling, and the movement is sensori-motor. Had the hot iron been applied to the paralysed limbs, no movement would have followed, because the path of the stimulus was cut off as completely as the current of the electric stimulus is interrupted when the telegraphic wires are cut across.

Experiments on animals have yielded the most striking instances of complex acts, simultaneous and sequent, in answer to sensory stimuli. Take away that part of the brain of an animal which lies above the sensory ganglia, namely, the cerebral hemispheres, and it is still capable of a variety of sensori-motor movements, though it does not display the least evidence of intelligence, emotion, or will. Flourens, whose experiments have been repeated by Longet, Schiff, and others, removed the cerebral hemispheres of a pigeon, and observed the results. It ceased at once to evince intelligence and power of spontaneous action, and remained in a state of torpor, as if it were asleep. But if thrown into the air, it would fly; if laid on its back, it struggled on to its legs; the pupil of the eye contracted to light, and if the light was very bright, the eyelids were closed. It dressed its feathers when they were ruffled, and sometimes followed with a movement of its head the movement of a candle before its eyes; and, when a pistol was fired off, it opened its eyes, stretched its neck, raised its head, and then fell back into its former torpid attitude until another stimulus was applied. To each sensory stimulus it answered by making the proper movement in a mechanical way: the impressions of sense reached and affected the sensory centres, which in turn instigated the proper reflex or automatic acts. There was neither intellectual perception nor volitional action; and it would have died of hunger with a plateful of food before it, though it would swallow food when this was pushed far enough into its mouth to come within the range of the reflex movements of deglutition. The animal was brought to the level of the invertebrata, which have no higher nerve centres than sensory ganglia, no centres of intelligence and will, and which execute all their varied and active movements, seeking what is good for them, avoiding what is hurtful to them, and providing for the propagation of their kind, through sensory and associated motor nuclei.

Similar experiments have been made on other animals with similar results. Vulpian made a complete transverse section of the nerve centres of the rat immediately above the medulla oblongata, and then pinched its foot severely: it uttered a short, sharp cry of pain which presumably was reflex or sensori-motor, just like the cry which an anencephalic infant may make. He then destroyed the medulla oblongata, and again pinched the foot: there were reflex movements, but there was no cry. In another experiment he removed the cerebral hemispheres, the corpora striata, and the optic thalami of a rat, when it remained perfectly quiet; but immediately a sound of spitting was made in imitation of that which a cat makes sometimes, it made a bound away, and repeated the jump each time that the noise was made.* The rat, by reason probably of having been hunted through many generations, is very fearful, scampering away on hearing the least unusual sound; and, though its cerebral hemispheres were removed, it still responded to the sensory stimulus to the auditory ganglion by the proper automatic movements. Longet having removed the cerebral hemispheres of young cats and dogs, introduced into their mouths a concentrated bitter decoction; he observed that they performed active movements of mastication, and made grimaces with their lips as if they sought to get rid of a disagreeable taste; they made, in fact, the same movements as he observed were made by an uninjured animal of the same kind when it was made to swallow a similar bitter decoction.

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* VULPIAN, *op cit.*, p. 548.

Many more experiments of a like kind might be adduced, but it will suffice to mention the recent experiments of Goltz upon frogs. When a frog, the cerebral hemispheres of which have been removed, is placed on the palm of the hand held horizontally, it remains there crouched quietly; if the hand be now gently turned, it will move first one paw and then the other, so as gradually to get upon the upper border of the hand as this rises, and to prevent itself from falling; and if the turning be slowly continued, it finally gets carefully on to the back of the hand, when this is uppermost, and there sits quietly until the hand is gently turned backwards again, when it goes through the reverse operations. To the sensory stimuli from the muscular sense it responds by the adapted automatic movements, as exactly as if it still possessed its nerve centres of intelligence and will. In fact, the same agency is put in motion by the sensory stimulus to accomplish the proper movements as would have been made use of had the stimulus come from the will of the animal; and while the sensory stimulus can excite the movements without the will, it would be quite impossible for the will to accomplish them without the automatic agency of the lower nerve centres.

Another interesting experiment is the croaking experiment (Quakversuch). If the frog which has been deprived of its cerebral hemispheres be gently stroked between the shoulders or along the flanks, it will croak once at each stroke with machine-like regularity; differing in this respect from an unmutilated frog, which either will not croak at all, or will croak several times, its cerebral hemispheres enabling it either to control or to strengthen the reflex act. But even frogs which do not croak so long as they possess their cerebral hemispheres will croak readily and regularly when these have been removed. However, none of them so mutilated will croak their gratification in this way if the stimulus be painful instead of pleasant. If touched or stroked with a sharp instrument, or if electrical or chemical irritation be applied to the skin of the back, they execute defensive movements and may make a cry of pain, but will not make the croak of contentment.

The movements in answer to impressions on the senses are, like the simplest reflex movements, primary and secondary automatic. Examples of primary automatic movements are to be found in the contraction of the pupils and the involuntary closure of the eyelids when a strong light falls upon the eye; in the distortion of the face in consequence of a sour taste; in the quick withdrawal of the hand when it is touched by something hot; in the cry which excessive pain calls forth; in the motions of sucking which take place when the nipple is put between the infant's lips; in coughing and sneezing; and in yawning on seeing some one else yawn. Illustrations of acquired or secondary movements of this class are seen in the adaptation of the walk to the music of a military band; in the maintenance of the balance and attitude of the body, through combined impressions on sight and touch, during walking, running, leaping, dancing; in the articulation of words on seeing their appropriate signs, or hearing their sounds; in playing from notes on a musical instrument when the mind is occupied; and in many other of the common actions of life of which we are not conscious at the time, but of the necessity of which, were there no power of performing them automatically, we should soon become actively conscious * ([1]). We little

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* Mr. James Mill clearly recognised this class of movements, as Hartley had done before him. "Innumerable facts are capable of being adduced to prove that sensation is a cause of muscular action," p. 258. After instancing, as examples, sneezing, coughing, the contraction of the pupils, and the movements of the eyelids, he says: "We seem authorised, therefore, by the fullest evidence, to assume

think, indeed, how much we owe to the acquired automatic functions of the nerve centres of the different senses. In the expression of thought by speech, it is not certain whether the idea acts directly upon the motor ganglia; it may be that it acts first upon the auditory

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that sensation is the mental cause, whatever the physical links, of a great proportion of the muscular contractions of our frame; and that among those so produced are found some of the most constant, the most remarkable, and the most important of that great class of corporeal phenomena."—*Analysis of the Human Mind*, p. 265.

Their nature was also distinctly pointed out by Unzer, who cited instances, *e.g.*, many movements made during sleep, especially by somnambulists. "But the principal point is, that on this depends the secret of the instincts in those animals which probably do not feel the sensational stimuli of the instincts." Unzer's work was published in 1771. *Op. cit.*, p. 242.

Hartley's *Observations on Man* were published in 1749; and they are certainly surprising when we consider how little was known at that time of the anatomy and physiology of the nervous system. He supposed that when external objects affected the sensory nerves, they excited vibrations in the small particles of the medullary substance, which were propagated to the brain; "as soon as the vibrations enter the brain, they begin to be propagated freely every way over the medullary substance." . . . . "The subtle motions excited in the sensory nerves and medullary substance of the brain during sensation and intelligence, must, of whatever kind they be, pass into the motory nerves, and when they are arrived there, it is probable that they cause the contraction of the muscles." . . . . "The same motion that occasions sensation and intellectual perception passes through the seats of these into the motory nerves, in order to excite there the automatic and voluntary motions." As examples of this reflex action he instances sneezing, swallowing, coughing, hiccoughing, vomiting, and expelling the excretions, and "general convulsions from acidities, and other irritations in the bowels." He even extends this doctrine of reflex action to the secretory and excretory vessels of the glands, which "must be constantly agitated with a like motion from the same causes, performing their ordinary secretions and excretions thereby." Here then we have as clear an anticipation as could be desired of the doctrine of reflex action, and of its application to all nerve-centres.

ganglia and so excites the sensation of the sound of the proper word, or what would be the sensation were we actively conscious of it, and that this thereupon acts upon the motor ganglia and gives rise to the appropriate reflex movements of speech. It may be observed in regard to the automatic acts that, when completely organised, they are more perfectly performed the less we are conscious of them, that is, the more entirely reflex they are; wherefore it is that somnambulists are able to walk and run safely where they would not dare to walk or run if they were wide awake.

The instinctive actions of animals fall under the category of consensual acts: without the intervention of any conception, the sensation at once excites the appropriate movement, and the animal is almost or quite as skilful on its first trial as it is after a life experience. It is true that the instinctive life is extremely limited in man, but sensori-motor action plays a large part in such manifestations of it as are witnessed; in the taking of food the movements of mastication and deglutition, like the earlier ones of sucking, are in answer to sensational stimuli, as also are some of the co-ordinated movements necessary to the gratification of the sexual instinct. The adjustment of the human eye to distances, which takes place with such marvellous quickness and accuracy, is effected, according to the best authorities, by a change in the convexity of the lens and perhaps of the cornea, and by an alteration in the direction of the axes of the eyes. It is not a voluntary, not even a conscious act, but a consensual act in respondence to a visual sensation, and it is well suited to convey a notion of what an instinctive act in an animal is.

It is plain enough that the intuitions of the distance and form of objects, which are acquired by man, are innate in many of the lower animals. The young swallow can apparently seize its small prey with as exact a skill on the first occasion as the old one can after a life-experience; and there is a certain Indian fish which brings down the insects on which it feeds by shooting a drop of water at them from its snout as they move above the surface of the water, and which is said seldom to miss its aim. When we consider that the refraction of the rays of light on entering the water will cause the insect to appear at a different spot in the air from that at which it really is, and that the difference between the real and apparent position will vary according as the rays of light enter the water more or less obliquely, we shall wonder the more at the remarkable intuition displayed. There can be no doubt, however, that the act is entirely automatic; innate functions of the kind are limitations which compel and confine the animal to fixed routes of machine-like action; and the absence of such limitation in man's original nature marks his higher freedom. Still it is interesting to observe how much even he is indebted to original endowment in this very matter of estimating distance. For what is the immediate cause that determines the muscular adjustment of the eye to distance? The act is consensual, or, using the vaguer term, instinctive, in respondence to a visual sensation or picture—an act of which there is no direct consciousness, and over which the will has no direct control. Though the process is confused and uncertain at first, unlike in that regard the process in the lower animals, yet it is not long before the proper muscular adaptations are acquired and definite motor intuitions organised. Plainly, then, very much is due to the pre-arranged constitution of the nervous centres even in man.

We are under no little difficulty when we try to realise how far consciousness accompanies many so-called sensations and their respondent movements; the question being whether consciousness is an essential element in the action, not of a sensation because the word implies consciousness, but of a sensational stimulus upon the sensory ganglion, the passage of the resulting molecular motion to the associated motor nucleus, and its ultimate issue in the proper movement. But that, it may be objected, is nothing else than a question whether consciousness is a necessary part of sensation; a question which can hardly be seriously asked. Not quite so, as will be evident if we do not suffer ourselves to be satisfied with a somewhat vague term, but resolve to apprehend the facts as distinctly as possible.

When an impression on sense has affected the sensory ganglion, the resulting disturbance may be discharged in two ways: it may either travel upwards to the cerebral centres, where it is perceived, and is without doubt then a conscious state; or it may pass along the sensori-motor arc into some movement, when it is not so certain that it is a conscious process. Certain it is that our natural bias is to attribute too much or too distinct consciousness to a sensori-motor act, because we are apt to deduce from our experience of self-consciousness. In our mental functions the action of the cerebral centres and of the sensory centres are so intimately intermingled that we are unable to separate them by self-conscious analysis, and so run the unavoidable risk of assigning to the latter, when they act independently, qualities which may be derived from the former. Could we get inside the nervous system of the insect which has no cerebral hemispheres, or of an infant as soon as it is born, before its cerebral hemispheres begin their functions, and observe directly what part, if any, consciousness plays in sensori-motor action, it would be a vast help in our analysis. Inasmuch as we cannot obtain that insight, the right method is, first, to observe carefully the simplest instances, making no further inferences than they warrant, before we go on to study the more complex phenomena of intermixed sensation and perception in man; and, secondly, to make use of those in the interpretation of these, rather than to apply these to the interpretation of those.*

Bearing in mind that the sensory ganglia are a continuation of the grey tract of the spinal cord, differentiated by their connections with the nerves of the special senses, I would call to mind what was said in the foregoing chapter concerning the supposed consciousness of the spinal cord. The conclusion reached was that it was capable of responding automatically to stimuli by co-ordinate or adaptive movements, without possessing consciousness in any definite sense of the word. We may fairly suppose it possible then that the sensory ganglia, with their higher functional endowments, are capable of more complex automatic acts in answer to their special stimuli without the intervention of consciousness; the more so as there is no line of demarcation between sensori-motor and reflex acts. Let us take a simple instance —the contraction of the pupils to light: certain undulations strike upon the retina, are transmitted to the optic ganglia, reflected thence upon a motor nucleus, and the circular muscular fibres of the iris presently contract, whether we wish it or not, whether we know it or not; if the light be brighter, contraction of the eyelids follows. We are not in truth conscious of the contraction of the pupils unless we watch it in a glass. The efferent part of the process is clearly unconscious, whatever be thought of the afferent part. But are we conscious of the sensational stimulus in this instance; in other words, have we a conscious sensation of light? I think not, unless the sensation becomes perception, in which case it has passed beyond the sphere of sensory function to the higher sphere of the cerebral centres. The pupils of a person in apoplexy who is unconscious of sight or sound will contract, just as those of the pigeon deprived of its hemispheres will, when a strong light is thrown upon them. The pure sensation is not strictly a conscious state; we may rightly speak of an organic sentience and an ensuing movement that are not conscious.

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* In adopting this canon one is liable to be met with the reproach from the metaphysician, that it is a setting to work to deduce the greater from the less and to subordinate the higher to the lower. But it is an empty reproach: we believe the greater to include the less, the higher to rest on the lower, and think that a knowledge of the less will help to a knowledge of the greater, of the lower to a knowledge of the higher, without supposing that the greater or higher does not contain something which will not be so explained. To apply this something to the less or lower is, we say, an entirely false method.

This is a conclusion which may certainly be disputed, and the more easily because of the want of anything like a precise definition of consciousness. It may be said that the before mentioned experiments on the frog show plainly that it feels, that is, consciously feels, the stimulus; for it utters the cry of pain when it is scratched, the croak of gratification when it is stroked gently. How should the frog respond to the gratification or the pain unless it felt it? But we go beyond the facts when we assume that it does respond to the gratification or the pain; what we know is, that it responds to the stimulus, of which consciousness may be an incidental coeffect and by no means an essential accompaniment; that the croak and the cry are made in answer to their respective stimuli. The surprise would be if they were not, the constitution of the frog being what it is, so long as the properties of its tissues are maintained by the due circulation of blood in them. Let us take the other experiment in which the frog cleverly balances itself on the hand, as this is slowly turned, so as to prevent itself from falling off. Here it makes a series of complex movements in answer to a succession of stimuli from its muscular sense that are occasioned by its changing relations to the hand as this is turned. Is it conscious of these stimuli? If we refer to our own experience of similar stimuli operating in the maintenance of the attitude of the body and in the various adapted movements which we make for the accomplishment of special acts, it would appear that we are not conscious of them, so far as we know, and that those who affirm that we are so do really assume a consciousness which is not conscious. They, in fact, beg the entire question by the tacit assumption that we could not perform the adapted movements unless we were, without knowing it, conscious of the sensory stimuli of the muscular sense. So much concerning that which we learn from observation of simple instances.

Let us now go on to consider a more complex instance. It is well known that the fly-catcher will, immediately it is out of the egg, catch an insect with its beak. In like manner a chicken, very soon after its escape from the egg, pecks at a grain and takes good aim; that is to say, in answer to a visual sensation it adapts a set of movements with the most exact appreciation of the proper muscles to be put in action and of the degree of contraction required in each muscle—with the nicest accuracy of judgment—to the accomplishment of a difficult feat. The lives of most chickens would be far too short to enable them to learn this skilful art, were they under the necessity of learning it. Mr. Spalding has made some experiments on chickens which prove that they do not need to be taught. As soon as they emerged from the egg he put hoods over their heads so that they could not see, and kept them in this state of darkness for two or three days until they could run about; when he uncovered their eyes they appeared stunned or dazed for a minute or so, owing no doubt to the diffused molecular action through their nervous centres produced by the sudden impression of the undulations of light; but immediately upon their recovery from this state, when the molecular action was limited to the proper tracks, they followed the movements of insects and pecked at them with precise aim. In like manner, they made their way straight towards a box in which a hen with chicks was shut up, when they heard her chuck, struggling through grass and over rough ground, though hardly able to stand steadily on their legs. Even chickens that were still hooded tried in this way to get to the hen when they heard her chuck. He observed also that a young turkey only ten days old, which had never seen a hawk, was so frightened by the note of a hawk which was concealed in a cupboard, that it fled away from the cupboard in the greatest terror.

It will hardly be affirmed in these instances of so-called instinct that there is a distinct consciousness of the nature of the stimulus and of the ensuing actions; the simple sensory impression—in one case, of sight, in the other case, of sound—is the spring which puts in motion automatically the proper muscles.* This it does by a physical necessity, not by the will, nor perhaps with the consciousness, of the chicken. In like manner, when ducklings are hatched by a hen, they make their way into water as soon as they see it; the impression on the sense of sight determines their action, notwithstanding the consternation of the hen, and notwithstanding that they cannot have fore-knowledge of the qualities of water or prevision of what will happen to them when they get into it; and when they get into the water, the impression which it makes upon their bodies sets going the proper movements of swimming, just as happens when the frog that has been deprived of its hemispheres is put into water. On the other hand, chickens that have been hatched by a duck are not moved by her example to follow her into the water: she cannot educate them in the way she would have them go. It would be strange if ducklings and chickens did not thus act, in relation to water, in conformity with their nature; their differences of constitution representing, in the one case, a mechanism which has been organised through past ages in that special adaptation to water which enables them to swim in it; and, in the other case, a mechanism which has not been organised in relation to it at all. Could we penetrate the intimate construction, and disclose the secret springs of action, of the organic mechanism, we should without doubt perceive the result to be as clearly physical as are the successive motions of the piston and wheels of a steam-engine when the valve is opened which lets in the steam to act upon the piston. That the duckling swims and the chicken drowns in water is no more surprising than that wood floats and iron sinks in water. If we clearly realize this conception of an organic machine which has, through past ages of function, been now definitely organised to respond by physical necessity in special ways to special sensory stimuli, it will appear that consciousness, whether it exists or not, is not required for its operations—is, if it occurs, an incident rather than of the essence of the function.

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* The metaphysical psychologists, who make most of consciousness, do not seemingly attribute consciousness to instinct in man. Most strange, from their point of view: but so it is! "Man is indeed furnished with instincts, so far as he needs them, to impel and direct his movements, before his intellect is developed, or with respect to objects of which the intellect take no cognizance. Instinct is a blind, unconscious force; it is not knowledge."—*The Human Intellect.* By Noah Porter, D.D., LL.D., p. 176.

Having once got this conception fixed in the mind, we shall be the better fitted to estimate the phenomena of sensori-motor or instinctive action, without bias from our self-conscious experience. It is easier to believe that the chicken is unconscious of the automatic movements which it makes when it pecks at the grain, than to admit that it is unconscious of the sensory stimulus when it sees the grain. But why should we endow the special susceptibility or reaction of the sensory ganglion to the external stimulus with a quality of consciousness which it is not thought necessary to attribute to the special susceptibility or reaction which the associated motor nucleus shows to the stimulus from the sensory ganglion? Here, in fact, we are involved in the confusion which comes of the want of an exact agreement as to what is meant by consciousness; we suffer from the want of an exact definition in which men agree. When pressed hard by their opponents, those who uphold a diffusion of consciousness throughout the nervous system will say that although the chicken may not be conscious of grain or of insect, yet it is impossible to believe that its sensory ganglion is not conscious of the stimulus which the grain or insect is to it. But what is the meaning of this consciousness which is not the consciousness of the individual, but which is, nevertheless, attributed to the separate organs or parts of the body? Is it consciousness at all? Let the metaphysical psychologists answer to that question, who define consciousness as the knowledge which the mind of the individual has of its own acts and states. It is surely the fact that *I* am conscious only as an individual, as an *ego*, by the power which I have of introspective observation of myself: I cannot know anything subjectively of an alleged consciousness of separate organs or parts of my body which is not part of my consciousness as an *ego*, and assuredly I cannot know it objectively; it is therefore an assumption, which may be true or not, but for which we have no warrant, to ascribe consciousness to them.

If it be said that although *I* am not conscious of a sensational stimulus my sensory ganglion is, and that its simple consciousness does, unconsciously to me, affect the complex consciousness which I, as an *ego*, have, its special waves being merged and lost in the more complex waves of general consciousness, I cannot deny the possible influence; but at the same time cannot but think that to call it consciousness is to take a license of assumption which is unwarrantable, and to render discussion futile; it is to introduce a consciousness which defies subjective analysis and objective inquiry, and to rob the word of a definite meaning. Moreover, as I have already pointed out, it is an unnecessary assumption, once we have realised the purely automatic nature of the complex sensori-motor acts which excite our wonder.

However, if it be still insisted that the sensory ganglion is always conscious, even when the individual to whom it belongs is not, it will be necessary to ascribe the quality, as some logically do, to the spinal cord also, and, in those creatures which, like the hydra, have no nervous system, to the sensitive elements of their substance; and I know not how, having got so far, we can forbear ascribing consciousness to the structure of the sensitive plant, to chemical elements which display affinities for one another, and to the aspiring ascent of water in a capillary tube. It will only be going back on the road to the old philosophy which found the explanation of natural phenomena in sympathies and antipathies, in loves and in hates. If anyone chooses to affirm that the sun, by an act of will attracts the earth and keeps it in its orbit, in spite of the voluntary resistance which the earth, anxious to get away into space, opposes to the compulsion, I cannot argue with him; he silences me effectually, though he does not convince me. Certainly it behoves those who discover the diffused elements of a rudimentary consciousness in the movements of the sensitive plant and of the hydra, if not in the affinities of chemical elements, which becomes more specialised as we ascend to more highly vital structures, to take scrupulous heed to discriminate plainly between these low modes of consciousness, the existence of which they infer objectively, and that consciousness which alone we know directly; and to refrain from tacitly investing the former with all the qualities of the latter.

It must be borne in mind that the foregoing remarks have had reference to the primordial sensation of the chicken, while it was yet pure sensation, unmixed with perception. But in an animal with cerebral hemispheres this period of pure sensation must be brief and transitory. The moment the chicken has made the proper movements and picked up the grain, it has enlarged its experience of sensory stimuli by the coalescence with them of those which it has received from the muscular sense during the movements; and it is in the association of these experiences of the muscular sense with the visual sensation of the grain, that the perception of the latter as an external object begins to dawn. These associated sensations, retinal and muscular, when they have been agglutinated, constitute the perception.

The nearest thing in human experience with which we can compare the pure sensation, free from admixture of perception, is probably the so-called organic sense through which the brain is affected by the special stimuli of the several internal organs. Each organ is in intimate relation with the brain through internuncial nerve fibres, having, so to speak, a special correspondence with it; and we have good reason to believe that each exerts its constant and specific influence upon it, and, through it, upon the constitution and function of mind. This intimate and essential sympathy is exhibited and observed most plainly in the great mental revolution which is produced by the development of the functions of the reproductive organs at puberty. Coming into action abruptly at a certain period of life, they display their specific effects in a decided and somewhat abrupt manner; the effects being necessarily less evident with the specific sympathies of other organs which come into functional action directly after birth.

Now these organic stimuli, which affect us so essentially though we are not conscious of their operations, may provoke answering movements. I am not now referring to the contraction and dilatations of blood-vessels and the consequent disturbances of nutrition and secretion which they may undoubtedly occasion in other parts of the body, but to the movements of animal life. Flourens observed birds which had been deprived of their hemispheres to stand on one leg, and, after a time, owing probably to the sensory stimulus of fatigue, change to the other leg; shake their heads, and put them under the wings for sleep; ruffle their feathers, and sometimes plume them with their beaks. Neither intelligence nor will could have any part in the movements; they were sensori-motor, and some of them probably in answer to stimuli arising within the body. Similar movements to relieve fatigue or an uneasy position take place in ourselves when we are asleep, or when our attention is so deeply absorbed in thought that we have not the least consciousness of them. Let any one who is accustomed to write while standing at a desk request some person to mark and record the various movements of his body which he makes while his attention is so intently engaged in thought and composition that he is unconscious of what else he is doing, and he will be surprised how many he has really made. In animals the actions respondent to the organic stimuli constitute a great part of their daily activity; and in man, when the influence of the highest nervous centres is weakened by disease, or when an organic stimulus has an abnormal energy, as happens sometimes in insanity, we may see the instinct for food or the sexual instinct manifested in a perverted and shameless manner. So far there is truth in a remark made by Jacobi, that the actions of the insane have an instinct-like character, as their physiognomies assume an animal-like look. In a complete description of sensori-motor function it will be necessary to take account of the organic stimuli from within the body as causes of various purposive movements.

The difficulty which one has in bringing forward examples of sensori-motor action in man springs from the impossibility, in many instances, of eliminating the action of the cerebral hemispheres. As soon as a reflex sensori-motor act is performed it awakens an echo or repeating movement of itself in the convolutions. In some instances, however, the function of the hemispheres is suspended. The somnambulist, who walks in dangerous places and goes through a series of performances when asleep, clearly receives information from some of his senses, by which he guides his movements. In those cases of epilepsy, quoted in the last chapter to illustrate reflex action, in which the person, during the transient unconsciousness, goes on with the work which he was engaged upon when the fit seized him, and when he comes to himself is unaware of what has happened, it is evident that the acts are respondent to sensory stimuli. When a person is put under the influence of chloroform in order to have a surgical operation performed painlessly, it occasionally happens, if he is not completely narcotized, that as soon as the operation is begun he shrieks violently and struggles with all his might, displaying all the ordinary indications of suffering so plainly that a bystander is convinced he is in great agony; and yet when his consciousness is restored after the operation he is surprised when he is told that it has been done, declares positively that he felt no pain, and is unaware of his shrieks and struggles.*

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* Chloroform narcotizes the brain from above downwards—first, thought being affected, then sensation, and lastly the purely reflex acts. In these cases, it may be supposed that the cerebral hemispheres are narcotized, but that the sensory ganglia are not fully under the influence of the chloroform. Dr. Lauder Brunton has

Two explanations offer themselves: either he really felt the pain at the time, as he seemed to do, and when he came to himself had clean forgotten it; or the phenomena were entirely sensori-motor, the cries and struggles being as purely automatic as the cry and struggle which the frog deprived of its cerebral hemispheres makes when the skin of its back is sharply scratched. Schroeder van der Kolk mentions a case of a lady who had her breast amputated while she was under the influence of chloroform, and who, though she felt no pain, was perfectly conscious on awakening of having heard herself shriek. If she remembered the shriek, why should she not have remembered the pain had she really felt it? The same observer has also noticed violent shrieking in apoplexy, where there was not the least trace of consciousness manifested. Children learn to speak by reason of an involuntary impulse which they notably evince to reproduce a sound that is heard; and any one who has walked through a parrot-house, and heard the discordant screams which make the place hideous, must surely have sometimes felt an involuntary inclination to shriek also. The clenching of the teeth and hands during severe pain is probably a sensori-motor action, like the shrieking which is another motor expression of it, both acts unquestionably relieving it in some measure; indeed, were the spasmodic clenching to become a general convulsion, the pain would probably be no longer felt. One might perhaps inhibit the pain of acute neuralgia by producing violent convulsions, and in like manner inhibit convulsions by producing an agonizing neuralgia.

ingeniously surmised that sudden deaths under chloroform, during surgical operations, are not always to be ascribed to an overdose of the chloroform, but to the shock of the operation, which shock produced the fatal effect simply because the chloroform had not been given freely enough to narcotize the basal ganglia as well as the hemispheres of the brain. *Brit. Med. Journal*, Dec. 4th, 1875.

The instinctive acts of animals, however, as I have already pointed out, furnish the most striking instances of sensori-motor action. Instinctive acts differ from reflex acts, such as the decapitated frog performs, in being more complicated; they are equally automatic, but in them a combination and succession of movements take place in answer to a combination and succession of impressions. When we observe the wonderful operations which insects perform, it is hard to conceive that they are little more than automata, acting with almost mechanical constancy in answer to the stimuli which they are adapted to receive; but in reflecting upon their operations, it is incumbent upon us to take heed that we do not rashly measure the nature and range of their senses by the nature and range of our own. As Mr. Wallace has remarked,* their sight may far exceed ours both in delicacy and range, and may possibly give them knowledge of the intimate constitution of bodies analogous to that which we obtain by the spectroscope. Insects certainly appreciate sounds of extreme delicacy. Besides the minute organs plentifully supplied with nerves which are presumed to be the organs of hearing, the orthoptera (such as grasshoppers, &c.) have what are supposed to be ears on their forelegs. In flies the third joint of the antennæ contains thousands of nerve fibres which end in small open cells; these have been supposed to be organs of smell; or, it may be, although it is not so probable, that they are organs of some sense which man has not, and receive impressions of which he has not the least perception. Certain it is that insects have an acuteness of sense by virtue of which they are in intimate relations with surroundings which we cannot perceive; wherefore the automatic movements that are organically linked on to the impressions they receive appear to us marvellous and inexplicable.

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* "That their visual organs do possess some powers which ours do not, is indicated by the extraordinary crystalline rods radiating from the optic ganglion to the facets of the compound eye, which rods vary in form and thickness in different parts of their length, and possess distinctive characters in each group of insects. This complex apparatus, so different from anything in the eyes of vertebrates, may subserve some function quite inconceivable by us, as well as that which we know as vision."—*On Natural Selection.* A. R. Wallace, p. 202.

Not long since, a correspondent of a public journal related the following facts in a letter to it:—He raised a female tiger-moth some years ago from the caterpillar state, and put it in a gauze-cage in a smoking-room opening into a town garden; in less than two hours five male tiger-moths flew to the cage, although no flutter of wings or other sound was audible. He had sat in the same room with the window open and a light burning hundreds of nights without ever seeing a tiger-moth. It may fairly be presumed that the female moth made some peculiar noise inaudible to human ears, or emitted some emanation, imperceptible to human smell, by which the male moths were attracted. Were we to measure the delicacy of the dog's sense of smell by our own, we should gaze in wonder on what would seem the mysterious instinct by which it pursues its patient and sinuous course through field after field until it drives the hare from its hidden seat; or were we to allow the vultures no keener sight or smell than we possess, it would be impossible to understand how it is that, when not a creature of the kind was previously visible in the heavens, they should be instantly gathered together from the remotest quarters of the horizon to the spot where the carcase is. It is well known with what speed and certainty the carrier pigeon finds its way to its far distant home; and there are many stories telling how a cat or a dog which has been removed to a strange place far away from its home, under circumstances which rendered it impossible that the animal could have made observations by sight to guide it in returning, will nevertheless find its way back. If one might venture a conjectural explanation of so obscure a matter, it would be that it is guided back by a train of smells which it remembers as they are re-excited, just as a man who was finding his way home would be guided by remembering objects which he had seen. As we know that these animals have the same number and the same kind of senses which we have, we must suppose a much more acute susceptibility in one or more of their senses; but even then we cannot easily conceive how they should act at so great a distance. It helps not to assume a co-operation of reason, for the reason of the greatest philosopher would not prevent him from losing his way hopelessly under like circumstances.*

There can be no doubt that human senses, especially those of touch and smell, are capable of a much more acute development than that which they commonly receive. The loss of one sense is notably followed by an increase in the functions of those which remain, in consequence of the greater attention given to them. There is good evidence that blind persons may learn to distinguish colours by the touch. Dr. Abercrombie mentions two instances of blind men who were much esteemed as judges of horses: one of them declared a horse to be blind—though several persons had failed to observe the fact—by recognising a peculiar and unusual caution in its manner of putting down its feet; the other pronounced a horse to be blind of one eye, by feeling the blind eye to be colder than the other. He had known, too, several instances of persons affected with that extreme degree of deafness which occurs in the deaf and dumb, who had a peculiar susceptibility to particular kinds of sounds, depending apparently upon an impression communicated to their sense of touch. They could tell, for instance, the approach of a carriage in the street without seeing it, before it was taken notice of by persons who had the use of all their senses. They were, in fact, in the position of those lowly organised beings which have no special organs of hearing or of sight, but which are clearly in some degree sensible of vibrations of sound and undulations of light.(2)

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* "But let us suppose a nation of men, blind from their infancy, among whom a stranger arrives, the only man who can see in all the country; let us suppose this stranger travelling with some of the natives, and that one while he foretells to them that in case they walk straight forward, in half an hour they shall meet men or cattle, or come to a house; that, if they turn to the right and proceed, they shall in a few minutes be in danger of falling down a precipice; that, shaping their course to the left, they will in such a time arrive at a river, a wood, or a mountain. What think you? Must they not be infinitely surprised that one who had never been in this country before should know it so much better than themselves? And would not those predictions seem to them as unaccountable and incredible as prophecy to a minute philosopher?"—*Divine Visual Language: a Dialogue.* Bishop Berkeley.

All the senses have proceeded by evolution from the simple and primordial sense of touch; and when the higher senses fail, this sense is capable of resuming to some extent, even in the highest animals, its primordial and general functions. Mr. Levy declares that whether in a house or in the open air, whether walking or standing still, he can, although quite blind, tell whether he is opposite an object, and can perceive whether it is tall or short, slender or bulky; he can also detect whether it be a solitary object or a continuous fence, and whether it be a close fence or consist of open rails. Currents of air have nothing to do with this power; nor has the sense of hearing. It seems to him that he perceives objects through the skin of his face, which he has ascertained by experiments to be the only part of his body possessing this power. Stopping his ears does not interfere with it, but covering his face with a thick veil destroys it altogether; and it is not diminished by ordinary darkness, but it is by a fog.* This peculiar susceptibility would appear to be a modification of tactile sensation, existing only in that part of the skin which is habitually exposed, and specially educated in consequence; and it is of great interest, as marking an intermediate condition of development between touch and sight through which animals have probably passed, in the course of evolution, before the latter sense was distinctly differentiated and specialised. It helps us to conceive how, before a special organ of vision was formed, a portion of the covering of the body in the lowest organisms may have been differentiated so as to receive impressions which were neither impressions of touch, nor of sight exactly, but intermediate between the two—transition stages in the development of touch into sight. Bats at the present day display a susceptibility of the same kind; for they will fly about a room without striking against the objects in it after their eyes have been put out.†

The sense of smell may also be cultivated to a perfection of which we little think until we set ourselves to observe or collect instances and to reflect upon the matter. Digby tells of a man who, like the negroes, could distinguish the approach of an enemy by the smell, and his wife from other women by the same sense. A certain religious person possessed almost divination in this respect, for he was said to be able to recognise persons by their different odours, and even to distinguish chaste from unchaste women in the same way.* Haller remarks that negroes in the Antilles can distinguish by scent the footsteps of a negro from those of a Frenchman; † and Humboldt affirms that the Peruvian Indians in the darkest night can not merely perceive by their sense of smell the approach of a stranger, but can say whether he is Indian, European, or Negro. ‡ Dugald Stewart relates that James Mitchell, who was deaf, dumb, and blind, could tell by his sense of smell whether a stranger was present in the room or not, and indicate in what part of the room he might happen to be; it is probable that any dog would easily do the same thing. Idiots sometimes display a remarkable susceptibility of smell, accepting or rejecting, like animals, particular articles of food after sniffing them, or manifesting their liking or dislike for particular persons after applying the same test. § These instances prove that we might obtain a much more intimate knowledge than we do of the properties of many natural objects by our senses of smell, taste, and touch, were we to cultivate them systematically, and did we not depend so much as we habitually do upon the sense of sight; and they serve well to indicate not only how much the senses of animals may surpass ours in range and delicacy, but how probable it is that many of their complex instinctive acts which strike us with wonder have their springs in sensational stimuli by which we are not affected. Could we unravel the intricacies of their sensori-motor functions, there can be little doubt that we should discover the explanation of their most complex instincts. Unfortunately the necessary data are wanting.

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* Mr. Levy expresses his conviction that none of the five senses have anything to do with the existence of this power, which he considers to be an unrecognised sense, and calls by the name of "Facial Perception."—*Blindness and the Blind*, by W. Hanks Levy.

† The use of the same words to describe the qualities of the sensations of different senses points to this fundamental analogy—*e.g.*, softness of touch and softness of colour, a harsh sound and harsh colouring, a sweet taste and a sweet sound, &c.

* *Traité Philosophique et Physiologique de l'Hérédité Naturelle.* Par le Dr. Prosper Lucas, vol. i., p. 162.

† White, *On the Gradation of Man*, p. 148.

‡ Humboldt's *Cosmos.*

§ A case of the kind is related in *Body and Mind*, 2nd ed., p. 51.

I go on now to consider briefly the origin of instincts, moved thereto more particularly by an expectation of the light which the study of their mode of origin will throw upon the education of the nervous system of man. In the first place, there can be no dispute that instincts pass by hereditary transmission: the ant inherits the instincts of the ant, the bee those of the bee, the beaver those of the beaver, as distinctly as each inherits the anatomical and physiological characters of its progenitors. Indeed the fixedness of instincts is so great, and their transmission so certain, that, as Mr. Darwin has pointed out, they persist long after the conditions of life to which they were adapted have been changed. Among other instances, he mentions that young pigs sometimes squat when frightened, and in this way try to conceal themselves even in an open and bare place; that young turkeys, when the mother gives the danger cry, run away and try to hide themselves, like young partridges or pheasants, in order that their mother may take flight, of which she has lost the power; that the dog, however well and regularly fed, often buries, like the fox, superfluous food, and turns round and round on a carpet before lying down, as if to trample down grass to form a bed; and that lambs and kids discover the traces of their former alpine habits by the way in which they crowd and frisk on the smallest hillocks.*

From these examples we learn—first, that the tendency of instincts to pass by hereditary transmission is so strong that traces of them may be found centuries after a change in the external conditions to which they were adapted, and when they have long ceased to be of the least service to the animal; and, secondly, that the continued action, through generations, of changed external conditions, such as domestication implies, does modify the organism of the animal, causing a decay of the old instincts which are not in use, and the development of new instincts suited to the changed conditions. The original instinct of the dog was to howl like a wolf; its acquired instinct, which it has possessed so long that it has become natural, is to bark. We are brought face to face then with two laws: the law of heredity, and the law of variation; and it is in the operation of these two laws that we discover the mode of origin of new instincts and the probable mode of origin of all instincts from the beginning.

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* *On the Origin of Species by means of Natural Selection.*

Adopting the Darwinian law of evolution, we assume instincts to have been formed, as species have been formed, by the accumulation of slight differences which have been inherited. Unknown causes acting upon the brain have produced what have been called spontaneous variations of simpler instinctive actions;* if these variations were adapted to the external conditions, and gave the animal an advantage in the struggle for existence, they would survive by natural selection and be transmitted by heredity; and thus in the course of time they would be fixed in its nature. The occurrence of a variation, the perpetuation of an advantageous variation by natural selection, and its hereditary transmission have been the main factors in the development of the greater number of the more complex instincts. If it be asked whence came the simpler instincts which have been assumed as a basis for the development of the more complex, we must seek for the basis of them in the complex reflex actions from which, as already pointed out, they have proceeded by successive complications in accordance with the same laws of natural selection and hereditary transmission of variations; from the more complex reflex actions we may descend in like manner to the more simple, and from these to more simple still, until at last we reach the primordial reaction of the apparently homogeneous substance of the lowest forms of animal life. So we trace a gradual progression from the most simple and general reaction, through successive complications of reflex action, to those most special and complex sensori-motor actions which are called instinctive.

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* But why should they be called *spontaneous*, seeing that the term is so apt to occasion misunderstanding? They are surely the effects of antecedent causes, though we know not what these causes may be. They may be conceived to arise in two ways: either by a variation in the external conditions provoking an organic adaptation; or by a new impulse being generated from the combination of the organic antecedents, in like manner as a chemical compound displays properties that are not those of its constituents. It would be strange if while the simplest chemical combination develops entirely new properties, the infinitely more complex organic combination of two beings—each of which again is a complex result of organic combinations—did not develop new impulses or properties in the product.

Another way—though it is at bottom not another, but the same way—in which we observe instincts to be formed in the higher animals is by the transformation of intellectual into instinctive acts. It is certain that intelligent actions which were acquired by experience or education in the first instance have, after being performed during many generations, been converted into instincts and inherited. G. Leroy made the observation long ago that in districts where war is made against foxes the young ones, before they have had any experience, display more caution and cunning than old foxes in districts where they are not persecuted; and he accounted for the fact by attributing language to animals. While admitting that old foxes may use means to instruct their young, we may agree with F. Cuvier, who suggested the more probable explanation that the greater natural cunning displayed was owing, not to education, but to the hereditary transmission of acquired instincts. Birds in desert islands evince no fear of man when they first make acquaintance with him, but after they have had experience of the wanton destruction which he works among them, the sight of his near presence instantly excites an instinct to escape. It may be taken for granted that birds in inhabited countries would show no more fear of him than they do of sheep, were it not for the embodied memories which they have of the enemy which he is to them; Darwin has remarked that large birds are much more shy than small ones, because they have been more persecuted by man; and I may add that among small birds robins approach him more boldly than others because it has long been inculcated on children as almost a sin to kill a robin.

Many other facts of the same kind might be quoted, some of which were carefully observed and recorded half a century ago by Knight. He made trial with some pointer pups, having taken great care that when they were first taken into the field they received no instruction from the old dogs. The very first day one of the pups stood trembling with excitement, its eyes fixed, and all its muscles strained, pointing at the partridges, as its ancestors had been taught to do. A young polecat terrier was thrown into a state of great excitement the first time he ever saw a polecat, while a spaniel remained calm and indifferent. The taming by man of the animals which are now domesticated without doubt cost him great pains originally; and had there been no tendency to the fixation of acquired modifications by hereditary transmission, had the primitive instincts continued to display themselves with their original force in each succeeding generation, he would never have succeeded in domesticating them.* "Will the unicorn be willing to serve thee, or abide by thy crib? Canst thou bind the unicorn with his band in the furrow? or will he harrow the furrows after thee?"[*]

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* The following quotation shows what a clear conception Cabanis had formed of the modification of an organism by its environment, and of the fixation of the new organic habits or dispositions by hereditary transmission through successive generations:—"Des impressions particulières, mais constantes et toujours les mêmes, sont donc capable de modifier les dispositions organiques et de rendre leur modifications fixes dans les races. . . . Et si les causes déter-

These instances of instincts that have been acquired by the transformation of intellectual acts illustrate really the operation of the same laws which are manifested in the acquisition of complex instincts by the so-called spontaneous variation of simple instincts; the only difference being that the variation is produced, not by an unknown cause, but by human agency, and that its survival is brought about, not by natural, but by human selection. They may be regarded in the light of experiments which test and support the theory of the natural origin of instincts. We observe in our own experience that intellectual acts, when frequently repeated, are done easily by habit, and finally become automatic; habit may indeed be regarded in such case as instinct in the making. What we have to realize is that the nervous system of man and animal is moulded structurally according to the modes of its functional exercise, and that if these be definite in character and frequently repeated, it becomes in time an automatic machine which performs its habitual functions with mechanical certainty on occasions of the suitable stimuli. The formation of a certain conclusion in logic by an intelligent mind, when the

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minantes de l'habitude première ne discontinuent pas d'agir pendant la durée de plusieurs générations successives, il se forme une nouvelle nature acquise, laquelle ne peut, à son tour, être changée, qu'autant que ces mêmes causes cessent d'agir pendant longtemps, et surtout que des causes différentes viennent d'imprimer à l'économie animale une autre suite de déterminations."—*Rapports du Physique et du Moral de l'Homme*, J. G. Cabanis.

"Qu'est-ce que nos principes naturels, sinon nos principes accoutumés?" says Pascal. "La coutume est une seconde nature qui détruit la première. Pourquoi la coutume n'est-elle pas naturelle? J'ai bien peur que cette nature ne soit elle-même qu'une première coutume, comme la coutume est une seconde nature."

[*] Job xxxix. 9, 10.

premises are clearly apprehended, is as much an automatic necessity, or, if you will, an instinct, as the act of swimming by a duck when it is thrown into water. What is physical necessity, regarded objectively, is, as Wundt has remarked, logical necessity, regarded subjectively.

Not to anticipate what will come afterwards, I forbear to proceed farther with this matter now. Enough has been done by the foregoing short exposition of the nature and of the mode of formation of instincts to prepare the way for what I have to say touching those actions in man which may be described as acquired sensori-motor acts. To understand their nature, it is necessary to pass for a short time beyond the region of pure sensation into the higher region of perception, and to consider what relation the latter bears to the former. Sensation expresses merely the state of simple feeling without reference to an external cause; it is wholly within, entirely subjective: perception includes not only the internal feeling, but the reference of it to an external cause; it embraces the without as well as the within, is the synthesis of subject and object; wherefore every distinct perception implies actually a judgment. In order to acquire a perception, it would seem that two senses at least must co-operate; and in order to acquire the completest perception possible of an object, there must be a co-operation of all the senses which it is capable of affecting. Men are often one-sided or defective in judgment because they do not bring themselves into intimate relations with all the aspects of an object or event: they cannot understand it thoroughly unless they so stand under it that they perceive all its bearings.

Let us take the simplest perception conceivable: that of something external to us, something which is not ourselves. The muscular feelings co-operate with the sense of touch to give us this information. The order of events is presumably in this wise: the object excites the sensation, which is at first entirely subjective; the immediate outcome of the sensation is a simple movement, which thereupon brings into action the muscular sense, exciting certain muscular feelings; the effect of the muscular feelings is to produce further movements of the limb, whereby, pressing against the object or moving over its surface, or otherwise acting upon it, its position in relation to the limb is changed; the consequences of which are further modifications of the original sensation of touch in correspondence with further modifications of muscular feeling. In the association, fusion, agglutination, consilience, or synthesis, call it what we will, of these different impressions of the tactile and the muscular senses arises perception, which is necessarily at first of a very vague and obscure character. However, we have now got our perception, such as it is, of an external object, which on any future occasion of touch is represented mentally in relation to these other simultaneously or successively experienced sensations.* We perceive then the importance for the perfection of perception, in other words, for the acquisition of knowledge, of the capacity of a variety of movements of the organ. The more movements it is capable of and the more numerous the sensory nerves with which it is furnished, the more frequent are the occasions of sensations. We want to get every sensation which we can of it, by bringing the organ into every possible relation with it, in order to perfect our perception. So much truth then was there in the saying of the old Greek philosopher that man is the wisest of animals by reason of his having hands; the hands being capable of so great a variety of movements and being furnished with a highly developed tactile apparatus. In like manner, it might be said that the elephant is the most intelligent of quadrupeds by reason of its having a trunk; for the trunk is an organ which has an extreme delicacy of touch, and a great and varied range of action.

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* Our perceptions of space depend upon experience; our visual sensations are not images, but signs, the meaning of which we have to learn by experience. This we do by comparing them with the result of our movements, with the changes which we make in the outer world. The infant as it learns to grasp, to turn its eyes and hands to an object, to turn it over and over, so as to see it in all positions, learns to recognise the different views of it in connection with the movements. Thus a conception of the object is obtained, and we are ever afterwards able to imagine what appearance it would present if looked at from some other point of view, and what movements we should have to make in order to put it in that point of view. "I have often," says Helmholtz, "noticed a striking instance of what I have been saying in looking at stereoscopic pictures. If, for example, we look at elaborate outlines of complicated crystalline forms, it is often at first difficult to see what they mean. When this is the case, I look out two points in the diagram which correspond, and make them overlap by a voluntary movement of the eyes. But as long as I have not made out what kind of form the

We infer then that the distinction between object and subject is not given in our earliest sensations. The sensation felt is all that the infant is at first conscious of; it tastes before it perceives a cause of taste; there is no distinction of subject and object, of the ego and the non-

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drawings are intended to represent, I find that my eyes begin to diverge again, and the two points no longer coincide. Then I try to follow the different lines of the figure, and suddenly I see what the form represented is. From that moment my two eyes pass over the outlines of the apparently solid body with the utmost ease, and without ever separating. As soon as we have gained a correct notion of the shape of an object, we have the rule for the movements of the eyes which are necessary for seeing it. In carrying out these movements, and thus receiving the visual impressions we expect, we retranslate the notion we have formed into reality, and by finding this retranslation agrees with the original, we become convinced of the accuracy of our conception."—*Pop. Scient. Lect.* p. 304. We may note by the way that the process is fundamentally the same as that by which we form and test our generalizations in observation and reasoning.

ego. It is an organic part of nature and is not conscious of being a self. But it makes movements which meet with resistance, and it is out of this feeling of resistance that the idea of an object grows; when it has been experienced a sufficient number of times, the spontaneous inference of an external world is organized in the mind. The notion is really an induction spontaneously made from experience, at so early a period of life that no one can have the least memory of the moment or of the manner of it. But the correlate of the idea of an external world is the idea of a self to which it is external. This idea grows out of the internal impressions and the feelings of pleasure and pain accompanying them: the muscular feelings, the sensations of hunger and weariness, the double sensation which we experience on touching a part of our own bodies—these contribute gradually to the definite individualization of the ego in relation to the non-ego. It is a long time before a child attains to a definite conscious idea of its ego and speaks of itself in the first person, although, like the animal, it manifests from the earliest period a, so to speak, instinctive feeling of self. Here, as elsewhere, obscure instinct precedes definite knowledge. The lower we descend in the animal scale the less distinct becomes the consciousness of a distinction between the self and the not self, until, as we have every reason to believe, it ceases to exist. No one supposes a tree to possess it; and even those who think that the infusory animalcule has the simple primordial consciousness of sensation, will hardly go so far as to invest it with the higher consciousness of perception.

In considering the mode of origin of the ideas of subject and object in the human mind, it is important to remember, what some persons seem to forget, that we have an individual body to begin with; that there is a *physiological* union or consensus of organs before consciousness appears on the scene, the organism being a whole in which there is not a part but acts upon the whole, as the whole again reacts upon and through every part; that this union or commonwealth of organs, bound together by an intimate sympathy, is represented unconsciously in the brain as the central organ; and that when it is awakened into consciousness by external impressions, it becomes naturally the idea of self. The *ego* is the unity of the organism declaring itself in consciousness. When I touch a certain part of my body, I am conscious of a sensation of touching and of a sensation of being touched, both sensations in my *self*: the organism is the self, and consciousness only makes it known. Is it any wonder then that the idea of self should dawn as soon as conscious function begins, and grow into definiteness with its development.

We should be ill furnished for life if we were entirely dependent upon our tactile and muscular feelings, primordial and paramount as they are. In sight, hearing, smell, and taste we possess other important inlets of knowledge. When we perceive an object, such as an orange, we associate together all the sensations which it can produce in us—its colour, taste, smell, figure, and consistence; this combination of sensations constituting the object as perceived by us. Whether the object has an actual existence distinct from the sensation or perception of it, as most persons think, and, if so, how far it corresponds to the perception; or whether, as Berkeley stoutly maintained, "all those bodies which compose the mighty frame of the world have not any subsistence without a mind" in which they are perceived; I shall not pretend to discuss. Suffice it for present purposes that all the knowledge of them we have is through the effects which they produce upon our senses—in fact, in perception. The more carefully we have looked at the object, touched it, experimented on it by the different senses, in order to get the greatest number of possible sensations which it is capable of exciting, and so to fulfil the conditions of sound induction, the more complete is the perception of it when present to sense, that is, when the proper nerve-currents are excited by its presence, and the more complete the idea or concept of it when it is absent from sense, but present to memory, that is, when the proper nerve-currents are excited by an internal cause. A person born blind would know an orange by taste, or smell, or touch, but his perception would of course want the sensation of those qualities which sight alone imparts; and if he were to acquire suddenly the power of seeing, it is certain he would not at first recognise the orange by that sense alone; before he could do so, it would be necessary for him to associate the new visual sensation with the experience of the other senses, especially of tactile and muscular sensation. This has been proved experimentally in several cases in which persons born blind have gained sight by means of a surgical operation on the eyes. In like manner, the perception of one who was born without smell or without taste would lack the information which the sensations of these senses respectively furnish; and if the absent sense were suddenly acquired, he would not recognise the object by it, until he had brought the new sensation into association with the previous experiences of his other senses: it would then take its place in the organized group or cluster of sensations which constitute the object. Cultivation of a sense whereby its susceptibility to impressions is sharpened, or the use of instruments which are adapted to increase its delicacy and range, will similarly add to the perception, when the information gained is brought into relation with the former sensations of which it is composed. But not otherwise. Were any one who had never seen a telescope or a microscope asked to look for the first time through a telescope at the moon, or through a microscope at a flea, he would not in the least recognise the object he was looking at.

The agglutination, blending, or organized grouping of separate sensations which constitutes the perception of an object, and which is fundamentally an induction or judgment, takes place, we believe, in the cortical centres; these being the higher nerve-centres in which the sensations of the lower sensory ganglia are co-ordinated into the idea of the object. This is what we mean when we speak of the process as a mental synthesis.* We now go

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* An acquired perception is truly an induction. The mind infers from the perceptive signs of one sense that there are properties of objects existing which, if trial were made, the other senses would discover. The difference between this induction and that which we call generalization is not in the process, but in the materials. The infant is engaged in making such inductions from the moment its mind dawns—at first, on a very few objects, which constantly recur, its universe being very limited, and its whole soul being absorbed in them; it constantly repeats the sensation and responsive movement, being gratified with trial and success, so that the perception is fashioned and fixed; it does not reflect upon the means by which it arrives at the result, but makes its inductions, like the clodhopper, unconsciously.

The perceptions which we thus derive from our senses cannot be analyzed and expressed in logical conclusions; but they involve the same kind of mental process as the conclusions of logic. "There appears to me to be in reality only a superficial difference between the 'conclusions' of logicians, and those inductive conclusions of which we recognise the result in the conception we gain of the outer world through our sensations. The difference chiefly depends upon the former conclusions being capable of expression in words, while the latter are not; because, instead of words, they only deal with sensations and the memory of sensations. Indeed, it is just the impossibility of describing sensations, whether actual or remembered, in words, which makes it so difficult to discuss this department of psychology at all."—HELMHOLTZ, *Pop. Sc. Lect.* p. 308. "If I know that a particular way of looking, for which I have learnt how to employ exactly the right kind of innervation, is necessary in order to bring into direct vision a point two feet off and so many feet to the right, this also is a universal proposition which applies to every on to remark that when we have once acquired in this way the definite perception of an object, it may on all future occasions be aroused by any one of the separate sensations of which it is constituted; either the sight of an orange alone, or the touch of it alone, or the smell of it alone, or the taste of it alone, will excite the idea of the orange, the other possible sensations being, as it were, understood. We know right well that these other sensations will be forthcoming if we

case in which I have fixed a given point at that distance before" (p. 310).

"The sensations of our nerves of sense are mere symbols indicating certain external objects, and it is usually only after considerable practice that we acquire the power of drawing correct conclusions from our sensations respecting the corresponding objects. Now it is a universal law of the perceptions obtained through the senses, that we pay only so much attention to the sensations actually experienced as is sufficient for us to recognise external objects. In this respect we are one-sided and inconsiderate partisans of practical utility; far more so indeed than we suspect. All sensations which have no direct reference to external objects we are accustomed, as a matter of course, entirely to ignore, and we do not become aware of them till we make a scientific investigation of the action of the senses."—HELMHOLTZ.

After pointing out the most striking analogy between names and objects, the connection of which must demonstrably be *learnt*, and sensations and the objects which produce them, Helmholtz says: "The elementary signs of language are only twenty-six letters, and yet what wonderfully varied meanings can we express and communicate by their combination! Consider, in comparision with this, the enormous number of elementary signs with which the machinery of sight is provided. We may take the number of fibres in the optic nerves as 250,000. Each of these is capable of innumerable different degrees of sensation of one, two, or three primary colours. It follows that it is possible to construct an immeasurably greater number of combinations here than with the few letters which build up our words. Nor must we forget the extremely rapid changes of which the images of sight are capable. No wonder, then, if our senses speak to us in language which can express far more delicate distinctions and richer varieties than can be conveyed by words" (p. 314.)

make the experiment, but it is as unnecessary to do so on each occasion as it is to spell each letter in a word when we have once learnt to read with ease. The nerve-current of one sense is sufficient for our purpose. Just as we pay away a cheque and other persons take it as payment, because we know that it represents its value in cash which will be forthcoming when it is presented, so we use the sensation as a sign of former perception, without testing its value by exciting the associated sensations. It is not only, however, in observation and thinking that we thus employ it as a sign. We employ it in the same way in acting, which is the outward issue or completion of observation and thinking: we observe in order to act, and judgment is the internal representation of the outward act in relation with the perception—that which would, if outwardly expressed, be the act. For this reason I have traced the relations of sensation and perception in this chapter; I could not else have placed our acquired sensorimotor acts in their true light.

Little observation is needed to show that the greatest part of the habitual acts which we perform daily are strictly automatic, and that the stimuli which excite them are sensational. Let it be noted, moreover, that these sensations act in their capacity of representative signs: assuredly we do not perceive all the qualities of the objects in reference to which we act; but one sensation, most commonly that of sight, serving as a sign of former perceptions, is sufficient to excite the appropriate movements. Here, indeed, we have the exact analogy of an instinctive act in an animal, the only difference being that in man has been acquired by education what in it has been inherited. When any one moves about in a house or room with the arrangements in which he is quite familiar, he is scarcely more conscious of the objects around him and of the greater part of his movements than he is of his movements of breathing or of his particular steps in walking; notwithstanding which, he does not run against the chairs nor stumble against the stairs, but fairly adapts his movements to the position and forms of the objects. But if some new piece of furniture be put in a part of the room where there was nothing before, or if some old piece of furniture have its figure changed,—if an additional leaf, for instance, be placed in the table—the chances are that he does stumble against it for a while, until, by familiarity or habit, the new sensation has taken its proper place in the organic groupings of former sensations and been associated with corresponding movements.

The sensory stimuli of the objects to which we are thoroughly accustomed affect us unconsciously, or nearly so; we see them, so to speak, without perceiving them, if we are used to them, when we are in such a state of abstraction that we should not see them at all, and we should not be affected by the stimuli of them, if we were not used to them. Perhaps the most striking illustration of automatic action is furnished by the monotonous processes of dressing and undressing which we have the trouble to go through every morning and night of our lives. One operation follows another in mechanical sequence, while consciousness is absorbed in some train of thought, and it is only when something has occurred to interrupt the habitual sequence of acts, or when our attention has been aroused in some other way, that we become conscious in what an automatic fashion we are proceeding. The successive sensations do duty for perceptions, and arouse the movements which are organically linked to them. So customary is it to wind up one's watch after taking it out of the waistcoat pocket on going to bed, that it must have happened to many persons to have on some occasions wound up their watch without intending it, indeed quite unconsciously, when changing their waistcoats in order to dress for dinner; and I have known a person to go so far as to put on his nightshirt instead of a clean shirt under the same circumstances. Again, it has sometimes happened that, when the mind has been deeply interested in a train of thought, a person has walked from one place to another through streets busy with the turmoil of traffic and the coming and going of men, and yet been unable, on reflecting afterwards, to say positively along which of two streets he came, though he has undoubtedly had what may be called sensory perception of the persons and objects which he has avoided in his walk.

Many other instances of a like nature might be easily adduced, but I shall content myself with calling attention to the firm association which is established by education between particular sounds, or particular visual sensations, and the adapted complex movements for the articulation of the appropriate words. Children plainly exhibit a tendency to imitate a particular sound, when there is certainly not yet any idea of what the sound means; and, as every one knows, it is easy enough to read aloud without paying the least attention to the meaning of what is read, the consciousness being otherwise engaged. Dr. Radcliffe relates how he once knew a bright little English girl, about five and a half years of age, who could speak English, French, and German with equal readiness. If spoken to in English, she invariably answered in English; if in French, she always answered in French; and if in German, always in German. When addressed in one language, and urged to reply in one of the other languages which she understood, she could not do so, and if pressed beyond a certain point burst into tears: a good and obedient child, she could not be coaxed, bribed, or urged to reply in a different language from that in which she was addressed. Dr. Radcliffe's attention was called to the fact by the governess, an intelligent person, who could not account for what appeared so singular an act of disobedience. The child died when she was about eleven years old from some affection of the brain, which was supposed to have been brought on by over-education.* There was no doubt that the child connected definite ideas with the words used in the questions put and the replies made; but the fact that it could not put the same ideas into another language than that in which it was addressed, showed the dominion exercised by the sound over the articulating movements—the mechanical connection established between them. Three special sounds were adapted to excite one idea, which was capable of expression in three special movements of speech, having in fact its three special tracks through the brain; but the special sound in each case, acting in its character of sign or excito-motor stimulus of the idea, compelled the movement to which it had been organically linked by education.† It is hardly necessary to point out that language, difficult as it is of acquisition, ultimately gets all the unconscious facility of a reflex act; experience proving too well that many waste floods of vain words are poured forth without fatigue by some who, like officious Peter proposing to build three tabernacles, know not what they say. Assuredly consciousness is not an essential accompaniment of speech, which may be conscious, sub-conscious, or entirely unconscious.

It is of the utmost importance to true conceptions of mental function that the full meaning and real bearing of the foregoing facts should be distinctly realized. When the sensation excites an acquired sensori-motor act, we must suppose that it does so by virtue of the acquired nature of itself and of its sensory nerve-centre; that, in fact, it is by virtue of this acquired nature that an object, which has been known by perception, is capable of acting merely as the sensory excito-motor stimulus of adapted movements. For we can hardly suppose in such case that the molecular current excited by the stimulus ascends from the sensory ganglion to the higher cerebral centres, and descends from them to act upon the motor ganglia, or that, having so ascended, it re-acts upon the sensory ganglion and then passes to the connected motor ganglia. One of these events, no doubt, is what happens when there is a distinct perception of the object, but it is a superfluous and improbable journey to make when the object is not really perceived, and when one quality of it, signifying, if we choose to attend or to perceive it, all its other qualities, excites a sensation which acts in its artificial character of a sign of the perception —by virtue, that is, of the acquired nature of its nerve-centre. Moreover, notwithstanding the intimate structural and functional relations between sensory and cerebral centres, the supposition of an ascent of motion to the latter is opposed to what we have learnt concerning the instinctive acts of animals, and concerning the sensori-motor acts of animals which have been deprived of their hemispheres. These last experiments, if they have been rightly interpreted, seem indeed to be decisive against the argument of an ascent.

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* Man Trans-Corporeal. *Contemporary Review*, December 1874.

† Narcisse Palletier, a Frenchman, who had lived so long among savages as to have forgotten his own language, soon recovered it, and forgot his savage language, when he was rescued. The old sounds, when once remembered, soon excited the old movements to which they were linked; no doubt, if he had fallen again among savages, he would soon have recovered their language when he heard the sounds of their words.

It is necessary to be constantly on our guard to prevent physiological conceptions of mental phenomena from being overruled or vitiated by psychological terms. Sensation is not, as the psychological use of the word might seem to imply, a certain inborn faculty of constant quantity, but a general term embracing a multitude of particular phenomena that exhibit every degree of variation both in quantity and quality. Simple as a sensation appears, it is in reality infinitely compound, being formed by a fusion of elements. A simple tone is one which is caused by a combination of simple wave-forms; a ray of light is notably a very complex affair; and even our perception of colour is an induction. It has been supposed that all our sensations of colour are compounded of three elementary modes of sensation—red, green, and violet; Helmholtz adopting Young's hypothesis, that there are three classes of optic-fibres distributed pretty equally over the surface of the retina, which answer to the undulations of these colours, in other words, which minister to these three modes of sensation. The purest coloured light of the spectrum excites more than one class of fibres, so that our common sensations of colour are never pure elementary feelings; the red rays, though they affect most powerfully the fibres sensitive to red, affecting in a less degree the other two classes of fibres. If these are incapacitated by allowing the eye to rest for a time on the complementary colour and so exhausting them, and if the eye be then turned to the required colour, a much purer colour is obtained. Whether there are really three sets of fibres, or whether the three colours are produced by different excitations of the same fibres, matters not; they are still complex. It has been discovered that ordinary sounds consist in like manner of complex aggregates of undulations of different pitches. We perceive, then, that sensations which seem elementary to consciousness are actually compound, and learn furthermore that no amount of skill in subjective analysis could ever have given us the least conception of their complex nature.

If a sensation which seems to be elementary is thus complex, how much more complex must be the acquired sensation which is gradually matured in the proper nervous centres from the residua or traces which previous sensations of a like kind have left behind them; the sensation of a cultivated sense thus summing up, as it were, a thousand experiences, as one word often sums up the accumulated acquisitions of generations of men. Education can assuredly improve every sense we have in a remarkable manner. An experiment by Volkmann has shown that when the finger or any limited portion of skin on one side of the body is frequently experimented upon with the compasses, in order to test the degree of sensibility, its tactile sensibility is thereby increased above the level of that of the adjacent parts; and what is more remarkable is, that the sensibility of the symmetrical portion of skin on the opposite side of the body will be found to have been also rendered more acute. Instances of improved sensibility of smell, taste, and hearing are too familiar to need mention.

A patient and thorough study of the phenomena of vision is no doubt best suited to show how composite a product a mature sensation really is, for it will show that in the education of sight there is a gradual transformation of elementary sensations into what finally stand for simple intuitions of the mind: the cultivated visual sensation of an object really being a complex sensori-motor process which represents an implicit judgment of its distance, magnitude, and direction. The experience of those who, having been born blind, have afterwards gained sight, proves that an object seen for the first time seems actually to touch the globe of the eye, and is not recognised, if it be even distinguished as an object; not the least information is given concerning its form, size, and situation; the information which cultivated sight gives has been added unto it by education, and is a product of its acquired nature. As Berkeley aptly says, vision is a language speaking to the eye, which we are not conscious of having learned, because we have been learning it ever since we were born, whenever our eyes are open in the light (3).

The fact is, that we do not see, hear, or otherwise feel by sense the object itself, and have no guarantee that what we feel has any resemblance to the object; what we feel is the effect that is produced in the nerve-centre by the external stimulus, an effect which must needs contain the complex results of the experience embodied in the acquired or differentiated nature of the nerve-circuit; and if the sensori-motor current were excited in exactly the same way by an internal cause, no external object being present, we should have exactly the same feeling of it, just as dreamers and madmen have. Innate in the constitution of the different ganglionic centres is a specific power of reaction to certain impressions made upon organs that are specially adapted to receive them; but as the waste following activity is restored by nutrition, and a structural modification is thus embodied in the constitution of the nervous centre, becoming more complete and definite with each succeeding impression, it comes to pass that an acquired nature is gradually grafted on the original nature of the nerve-centres, and that the sensation gains infinitely in complexity.

The idea to be formed and fixed in the mind from a consideration of the phenomena of the development of sensation, and necessary to their proper interpretation, as indeed to the interpretation of every manifestation of life, is *the idea of organization.* The mind is not like a sheet of white paper which receives just what is written upon it, nor like a mirror which simply reflects more or less faithfully every object, but by it is connoted a plastic power ministering to a complex process of organization, in which what is suitable to development is assimilated, what is unsuitable is rejected. By the appropriation of the like in impressions made upon the senses we acquire a sensation, of which we might speak, as we do when speaking of idea, as *general* or *abstract;* there is a sort of organic classification; and there exists henceforth, latent or potential, in the sensory centres, something that may be called a faculty, which on the occasion of the appropriate impression renders the sensation clear and definite—in other words, gives the interpretation. It is exactly like what happens in the spinal centres, and exactly like what happens, as we shall hereafter see, in the supreme cerebral centres. Coincident with the assimilation of the like in impressions, there is necesssarily a rejection of the unlike, which, being then appropriated by other nerve tracts, becomes the foundation, or lays the basis, of the faculty of another sensation, just as nutrient material which is not taken up by one kind of tissue element is assimilated by another kind. In the education of the senses, then, there takes place a differentiation of cells—in other words, a *discernment,* as well as an improvement of the faculty of each kind of sensation by the blending of similar residua. There is an analysis separating the unlike, a synthesis blending the like; and by the two processes of assimilation and discrimination our sensations are gradually formed and developed. The process illustrates the increasing speciality of individual adaptation to external nature; and the length of childhood in man is in relation to the formation of his complex sensations.

Thus much concerning sensation and sensori-motor action. It is a hard matter for those who take the psychological view of mind to realize the firm organic connection that is established between the sensory stimulus and its proper movements—the feeling and the act—whereby these finally become as automatic as the motions of a clock's hands. When they observe an end to be accomplished they fail not to fly incontinently to the notion of design. The act, with whatsoever design it displays, is the necessary result of a certain constitution, innate or acquired, of the nervous centres, and is not dependent either upon volition or consciousness. Whether consciousness exists or not as an accompaniment, is another question; automatism does not necessarily exclude consciousness; and it is certainly conceivable that some animals are conscious automata, and that, though acting with mechanical necessity, they feel pleasure or suffer pain in doing what they do. Those persons go far beyond this supposition, however, who assume that the nervous centres of man or animal, when performing automatically a series of co-ordinate movements, possess a *notion* of the end which they effect, or display any degree of intelligence and volition. They probably possess no more of such notion than the elements of a chemical compound have of the end which they accomplish when they combine, or than the wind has when it bloweth where it listeth; * and accordingly they do not fail sometimes, under conditions of disease, to make terrible mistakes, and to cause much suffering to and perhaps miserably to kill the individual by continuing violently reflex actions the cessation of which was necessary to the preservation of life. Even so philosophical a writer as Müller inferred that the sensory centres were endowed with some degree of voluntary power, because of the remarkable actions to which they minister; thus introducing into his observation, and applying to his interpretation, of the functions of the secondary nervous centres conceptions derived from his knowledge of the functions of the higher or primary centres. This was surely to reverse the natural order of inquiry, and to apply the complex and obscure to the interpretation of the simple, instead of ascending by inductive steps to use the simple in order to disentangle the complex. The before-mentioned experiments upon the frog's spinal cord prove that movements seemingly purposive may be purely automatic: why then introduce a new agency, derived from experience of the highest cerebral centres, in order to account for sensori-motor functions which, though more complex than, are of the same character as, those of the spinal cord?

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* "Whoever will examine the language of mankind, may find that we apply expressions to bodies which belong properly to our own manner of proceeding; and, how well soever we know the contrary, speak of them as voluntary agents, exercising powers of their own; thus it is said that the wind bloweth where it listeth, and we say of water that it will not mingle with oil, that it will force its way, &c.: terms expressive of a choice, compliance, and resolution similar to those exercised by man."—TUCKER's *Light of Nature*, vol. ii. p. 545.

The answer which I conceive it probable may be made is this—because the sensory centres are intermediate in structural position and physiological dignity between the spinal and the supreme cerebral centres, and may be expected, while exhibiting reflex functions like those of the spinal cord, to exhibit also the rudiments of functions which attain their special development in the cerebral convolutions. They are more special and complex in structure than the spinal centres, receiving and co-ordinating a greater variety of impressions, and it may be argued that they possess not only some degree of consciousness but the germs of intelligence and volition. At any rate, if it be not so in man, there is evidence that it may be so in some of the lower animals. It would appear that the ant and the bee, which have no higher nervous centres than sensory ganglia, and in which the functions of these centres reach a remarkable perfection, are not simply organised machines that operate with unvarying regularity and are destitute of any power of shaping their acts to new experiences; on the contrary, observation shows that these creatures do sometimes discover in their actions indications of a sensibility to strange experiences and of corresponding adaptations of movements. Take Huber's account of the humble-bees which he put under a bell-glass along with a comb which was of such a shape as not to be capable of standing steadily. Two or three of the bees got upon the comb, and, stretching themselves over its edge with their heads downwards, fixed their fore-feet on the table, so as to make themselves props and to prevent the comb from falling. When they were tired, others took their places, and the series of reliefs went on for nearly three days, until the bees had prepared sufficient wax to build pillars of support. Moreover, when the first pillars were displaced, they had recourse to the same operations in order to rebuild them. We could scarcely have a more striking instance of an apparent adaptation of means to an end according to varying circumstances. And I know not how those who would attribute such appropriate action to instinct can distinguish it from understanding, even if it be assumed that similar experiences must at some time have occurred to the race of bees. After all, it is only a manifestation of a power of adapting acts to circumstances by which we must suppose, and Mr. Darwin has shown it to be probable, that bees have gradually acquired their wonderful instincts, and which at bottom is a property of nervous tissue, if not of organic substance.* The power is evidently of a rudimentary kind in bees, and must remain so in creatures that have not the higher nerve-centres in which sensations are combined into ideas, perceptions of the relations of things thus acquired, and acts purposely shaped in consequence to accomplish ends whether the circumstances are changed or not. But because bees have possessed, and still possess, this rudimentary understanding, which differs in simplicity rather than in kind from human understanding, it does not follow that the sensory ganglia of man are endowed with similar rudimentary functions. On the contrary, it might be argued that as higher nervous centres are differentiated in the course of evolution, functions are localised in them which were more generally diffused in the lower animals, not otherwise than as the fore limbs in man, which in the ape and some other animals serve both for grasping and walking, are specialised in structure and function as prehensile organs. In the absence then of positive evidence of intelligence and voluntary power in the sensory ganglia of man, it is a scarcely warrantable assumption to endow them even with the rudiments of these functions.*

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* Mr. Wallace has broached and upheld the opinion that bees and ants do not act without instruction and blindly. He thinks that birds build their nests, as men build their houses, from observation, memory, and imitation, using the material which each kind can most readily obtain, and building in situations most congenial s habits. Indeed, he asserts that "the peculiar notes of birds are acquired by imitation, as surely as a child learns English or French, not by instinct, but by hearing the language spoken by its parents."

But it is impossible to feel an equal assurance when the question is made one not of the existence of intelligence and will, but of the existence of consciousness in the sensory centres. Three considerations occur to the mind in reference to this question. The first is, that in the higher animals properties are localised in particular organs which in lower animals are diffused throughout the organism; and while this may be used as an argument in favour of the supposition that consciousness is entirely limited to the cerebral hemispheres in man, it certainly does not exclude the possibility of its existence in the sensory centres. For it may well be that organs which are only a little lower in dignity than the supreme cerebral centres, which are essential to the development of their function, and which are in such intimate functional relation with them throughout life that a functional separation appears to be pure abstraction, do possess that property which is most highly, but not exclusively, developed in the higher centres.

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* Unless, as I have already pointed out, we take all heart of meaning out of the word volition, by calling the adaptive power of organic element by the name. After referring to Spallanzani's observations on polypes, Prochaska says—"From these and other facts it is manifest that these infusory animalcules feel, and have volition, and possess the character of the true animal; consequently, they are endowed with a sentient and volitional principle, however destitute they may be of a nervous system."

Secondly, it admits of no doubt that consciousness is not a constant quantity, but that there are gradations of consciousness from its most vivid manifestations through stages of lessening subconsciousness down to actual unconsciousness. It may well be then that the sensory centres possess it in a less degree than the centres above them. The plain proof that they do possess it, some might argue, is that we feel pain when we are hurt; and that the pain is felt in a sensory centre is further proved by experiments on animals which cry out when they are hurt, after their cerebral hemispheres have been removed. The argument, however, is by no means conclusive. In the first place, we have no proof that the animals feel the pain; all we know is that they cry out as if they felt it; and if we may trust our inferences from other experiments on animals and from observations of men under chloroform and in comatose states, we must admit that the cry may be purely a reflex act. In the second place, it is doubtful whether we ever are conscious of a sensation without perceiving, whether in fact we can have consciousness of a pure sensation: when we say we feel it, we feel it in a particular part of the body; and what is that but to perform internally a sensori-motor act and to recognise more or less clearly its *where*, in other words, to *perceive* it according to forms of space? We infer the existence of simple sensations out of which ideas are formed by a mental synthesis, but it is a question whether a consciousness of them does not imply that our higher cerebral centres have come into play and that we are exercising perception. To adopt the metaphysical theory which has been broached by some psychologists, that the organism in its relation to perception belongs neither to the *ego* nor to the *non-ego*, but occupies an intermediate position between them, is to dupe ourselves with vain words, which do not carry us a step farther towards an understanding of the facts; whether we accept it or not, the problem remains just what it was.

The third consideration is, that although the cerebral centres, as representing the highest and most complex co-ordination of functions, are undoubtedly the seat of clear consciousness, of the individual's consciousness as an *ego*, the sensory centres may still be conscious after a fashion of their own, and may send their unperceived contributions to make up the sum of that general consciousness which is the consciousness of the *ego*. This theory of an unconscious consciousness I have already discussed, and I need say no more about it now. The conclusion of the whole matter is, that while many plausible arguments may be brought forward on the one side and on the other, we have not the data to warrant us in deciding positively whether consciousness, or, if any, what sort of consciousness, is a property of the sensory ganglia, and that the question must for the present remain open.

One reflection we may profitably educe from the discussion, before passing from the subject—namely, how artificial and unwarranted is the absolute division which is made between the conscious and the unconscious, between psychology and physiology. Notwithstanding that nature everywhere reveals the law of continuity, and notwithstanding that the progress of knowledge has been a history of the breaking down of arbitrary divisions in knowledge where none existed in nature, we still go on to make nature conform to our divisions, and as soon as we are driven from one artificial barrier flee for refuge to another and insist on holding that at any cost. All creation's endless changes proclaim the continuity and the becoming of things: man proclaims the divisions of science and the immutability of knowledge. How much idle discussion would have been saved in times past, and would be prevented in times to come, had the true lesson been taken to heart! When it was found out that the earth was not fixed and immovable, men opposed the new doctrine as if all their faith and hope depended upon their holding fast to the old and false doctrine which they had so long cherished; when the geologists announced that the surface of the earth had been undergoing continuous changes through the ages, the mountains having been built up and the valleys scooped out by natural agencies, and the sea having become dry land and the dry land sea, the new doctrine was opposed with might and main; and now that in this day and generation it has been all but proved that the species of living things are not immutable creations, but have been formed by the gradual operation of natural causes through successions of ages, there is the same angry opposition made to the new doctrine, and the same passionate clinging to the old doctrine of fixedness is displayed. When a new and great truth is discovered, men too often act as if the earth were giving way beneath their trembling feet and heaven vanishing from their longing gaze, when it is merely the fabric of their ideas which is giving way, and when they ought to set earnestly to work to reconstruct it.

Has not the time come when we may justly ask ourselves whether there really is so great a gulf fixed as it has been the fashion to assume between brain and mind? It may be worth while at any rate to adopt by way of experiment the theory that consciousness, though the usual, is not the indispensable accompaniment of mental function — a constant concomitant, if you will, but not an essential factor — and that all the operations which are considered mental and to belong to psychology may be performed as pure functions of the nervous system, without consciousness giving evidence of them or having any part in them; and then to observe how far the theory will throw light upon the phenomena of the mental life. Reasoning would go on as before in that case, only there would be no inner sense of it. What appears to the outer senses as physical law appears to the inner sense of consciousness as logical necessity; they are two aspects of the same fact; were consciousness suspended or abolished, the fact and the function would remain though the logical cognition was lost; the physiological mechanism would perform its work whether its process and results appealed to the inner sense of consciousness or not, just as it would do whether it was watched or not by the outer senses of another person. To ascribe to consciousness an active part as cause in the cognition of a logical necessity is therefore no less absurd than it would be to ascribe to the outer senses of a scientific observer an active part in the causation of the physical law which they are making known to him. Whatever else may be thought, it can hardly be doubted that too much has been made of consciousness in times past, and that instead of mental phenomena revolving round it as the sun of the system, it is rather a sort of satellite of mind—the indicator which makes known what is being done, not the agent in doing it.

Let us suppose that one half of the brain may suffice to do all our mental work, as there is some reason to believe it may, and let us make the purely hypothetical supposition that the other half serves, by reason of its intimate communion and sympathy with it, to make us conscious of what is going on in the working half;

it is not difficult to conceive that something might occur to interrupt close intercommunion between the two halves, in which case it is plain that mental functions would go on without consciousness. That the division of the brain into two halves is the physiological condition of self-consciousness may be an untenable hypothesis, but there is nothing unwarrantable in the assumption that there is a certain unknown action of the brain which is the condition of consciousness, and that this action may be suspended without entailing an entire or perhaps even a partial suspension of those cerebral functions which, when conscious, are called mental. However, let the truth concerning the cerebral hemispheres be what it may, it hardly admits of question that sensations and their respondent movements, which are accompanied by consciousness when first experienced, are gradually organised in the proper nerve-centres, thus become automatic, and then take place as effectually without consciousness as with it.

The reaction of the motor ganglia that are in connection with sensory centres, whether designed or undesigned, co-ordinate or irregular, may be excited not only by impressions conveyed to them by the afferent nerves of the senses, and by the so-called organic stimuli, but also by a stimulus descending from the cerebral hemispheres. That cerebral activity which coming from above appears in consciousness as an idea or an impulse of the will, acts upon the secondary motor centres, and calls forth those movements which are commonly reflex to impressions from without. In such case it is tolerably certain that the idea or volitional impulse does not act directly on the motor nerve-fibres, but that it acts either upon the sensory nuclei and through them upon the connected motor nuclei, or, as is more probable, directly upon the ganglionic cells of the motor nuclei, in which the potentiality of the movement exists latent, statical, or, as it were, *abstract;* the stimulus from above disturbing the organic equilibrium, and releasing or setting free the movement together with whatsoever of design there is in it; the same operations are performed, and through the same instrumentality, as when the impression conveyed by the afferent nerve from without excites the movement. Thus the will is entirely dependent for its outward realisation in action upon that mechanism of automatic function which is gradually organised in the subordinate centres; it cannot, as we shall hereafter see, at once instigate successfully a new movement, nor can it execute any movement without a guiding sensation of some kind: the cultivation of the senses, and the special adaptations of their motor reactions which are gradually organised, are necessary antecedents, essential prerequisites, to the due formation and operation of will. The sensorium commune represents, in fact, various independent nervous centres, and never does act merely as a conductor transmitting unmodified the stimulus, whether this ascend from without or descend from the cerebral hemispheres. Bear this clearly in mind, and the memory of it will help to get rid of some difficulties, when we come to deal with the will.

It is not needful to say anything here of the seeming disproportion between the amount of energy expended in the answering movement, and the moderate stimulus to the sensory ganglia by which the movement is excited; inasmuch as what was said in this regard of the spinal centres is strictly applicable to the secondary nervous centres. A special inquiry would only serve here, as elsewhere, to set forth needless evidence in support of the principle of the conservation of force.

And now let me briefly indicate the general causes of disorder of the functions of the sensory ganglia: they are in the main such as have been already pointed out to be causes of disturbance of the functions of the spinal cord:—

1. As a natural fact, there may be an innate vice, feebleness, or instability of composition of the ganglionic cells. Such fault of nature is commonly owing to the existence of some nervous disease in the hereditary antecedents; but it may of course be due to any other of the many recondite causes of degeneration of nerve element. Hallucinations of vision are by no means infrequent amongst some children at an early age, especially among such as suffer from chorea. And in those rare cases in which insanity occurs in children soon after they are born, it is chiefly exhibited in violent and irregular sensori-motor movements; herein resembling essentially the insanity that sometimes ensues in animals. The unnatural laughter, the shrieking, the biting, and the tearing of the insane infant assuredly testify to a degenerate state of the motor and sensory cells in the sensorium commune: one might even venture to say that there was a true *sensorial madness*. It is most interesting to add that the disorder may alternate with, or be replaced by, general convulsions, the madness ceasing when the convulsions supervene; in such case a transference of the disturbance from one system of nervous centres to another takes place.

Again, there may be every degree of deficient sensibility down to actual insensibility of the ganglionic cells of the sensory ganglia. It is obvious that people differ naturally in the acuteness of their senses: there are undulations of light to which one person's retina is not sensitive, which nevertheless produce the sensation of light in another person; and there are vibrations of sound audible to one person which, either by reason of being too rapid or too slow, are inaudible to another. Moreover, singular idiosyncrasies in regard to the susceptibility of a particular sense are displayed in some instances, one person being overpowered by the scent of a rose, another fainting away if a cat be concealed in the room, and a third almost falling into convulsions if a piece of silk be sharply brushed with the finger. In idiots the senses commonly partake of the general stupidity, although a remarkably acute smell is now and then exhibited. The hearing is frequently defective; smell is often imperfect, the olfactory bulbs being insufficiently developed; taste absent or extremely vitiated, so that they will eat unconcerned the filthiest or the most pungent matters; and the sensibility of the skin is sometimes extensively absent, or it is generally dull, so that they suffer very little pain from injuries. The idiots of the lowest class have usually no other affection but that of hunger, which they exhibit by unrest, grunting, or the like; but even some of these miserable creatures have at times attacks of fury, without evident reason, in which they scratch, strike and bite, as the insane infant does.

Dulness of sensibility, when not nearly reaching the stage of idiotic degeneration, is of course unfavourable to intellectual acquisition; but, on the other hand, a very acute and delicate sensibility is attended with evils and dangers of its own. In the former case, although there is a hindrance to assimilation, yet that which is appropriated is commonly retained with great persistence; in the latter case, there is certainly quick reaction, but no lasting appropriation, and, if the sensibility is intensified beyond a certain point, there may even be a lapse into that degenerate state in which, not the special sensation, but pain is felt, and irregular and convulsive reaction takes place. When the sensory centre is acutely affected, perception is incomplete or absent, just as when there is strong emotion there is little knowledge. To know an object there must be little feeling; the organic sensations, which are all feeling, yield no knowledge. It is of no small importance that these natural differences in the constitution of the ganglionic cells should be plainly recognised, for they unquestionably are at the root of certain differences in individual character and intellect. The direction of a man's pursuits in life may be determined by the capacity of a particular sense, which naturally selects the class of impressions agreeable to it; and so determines the corresponding reactions, that is, the general course of the life-work.

2. An excessive use of the senses, without due intervals of rest, produces exhaustion, and, if continued, actual degeneration of them; here, as elsewhere, the force expended must be restored if the energy of the matter is to be maintained. A too powerful impression made upon any sense may also diminish, or actually destroy, its power of reaction; immediate paralysis of sight, of hearing, or of smell has followed a sudden and powerful impression upon the particular sense; and if the paralysis is not complete, the sensibility of the sense for weaker impressions may still be lowered for some time. After looking at a green colour for a while the sensibility of the retina to green rays is exhausted, so that when the eye is afterwards directed to white light the part of the retina susceptible to the green elements of white light is unaffected, and a sensation of the complementary colour, purple, is produced. Moreover, the sensation itself may persist for a while after the cause of it has disappeared, as when an image of the sun remains after we have ceased to look at it, or the roar of the cannon abides in the ears after the firing has ceased. The molecular vibrations excited in the nerve-centres continue for a few moments, and subside gradually. Such persistence of action in the ganglionic centre will serve to convey a notion of the condition of things which exists when a hallucination has been produced by internal causes. One of the best illustrations of the persistence of a sensation is afforded by the well-known experiment of rotating a circular disc with alternate black and white sectors. Above a certain rate of rotation there are no longer separate impressions

of black and white, but a continuous impression of grey is produced. The impression made upon the retina by a white sector continues during the short interval occupied by the passage of the black sector over the same point; the result being the same as if the quantity of light from the white sectors were distributed uniformly over the whole surface of the disk. In this way the maximum duration of an impression has been measured.

3. The state of the blood has a most direct effect upon the functions of the sensory ganglia. Too much blood, as is well known, gives rise to subjective sensations, such as flashes of light before the eyes and roaring in the ears; but it is not so generally known that when the abnormal action reaches a certain intensity, movements responsive to, or sympathetic with, the hallucinations may take place. Nevertheless, they may: as the sensory ganglia have an independent action in health, so also may they act independently in disease; and as in health there is co-ordinate or designed sensori-motor action, so in disease there may be convulsive sensori-motor action evincing more or less co-ordination or design. Of violent, but more or less co-ordinate, action we have, I think, an example in the raving and dangerous fury which often follows a succession of severe epileptic fits, and which I take leave to describe as in the main a *sensorial insanity*. The patient's senses are possessed with hallucinations, his ganglionic central cells being in a state of what may be called convulsive action; before the eyes are blood-red flames of fire, amidst which whosoever happens to present himself appears as a devil, or otherwise horribly transformed; the ears are filled with a terrible roaring noise, or resound with a voice imperatively commanding him to save himself; the smell is perhaps one of sulphurous stifling; and the desperate and violent actions are the convulsive reactions to such fearful hallucinations. The individual in such state is a

sensori-motor machine set in destructive motion, and he perpetrates the extremest violence or the most desperate murder without consciousness at the time, and without memory of it afterwards.

A deficiency of healthy blood is a cause of disorder of the sensory centres. A great loss of blood powerfully affects the senses; the anæmia of chlorotic and hysterical women is the probable cause of the many anomalous sensations and motor disturbances which disappear as the condition of the blood improves; and a manifest poverty of blood often accompanies the chorea of children with its hallucinations.

A perverted condition of the blood, whether from something bred in the body or introduced from without, is known to be a powerful cause of sensory disorder. Evidence of such injurious influence we have in the hallucinations which sometimes follow for a time certain acute diseases, as well as in the delirium which occurs in the course of them; in the effects which alcohol produces upon the senses; in the actions of poisons, such as belladonna and aconite, which markedly affect the senses; and especially in the operation of haschisch, a poison which appears to concentrate its action upon the sensorium commune. In hydrophobia the presence of a virus in the blood notably gives rise to most violent nervous disturbance; the sight or sound of a fluid, a movement in the room, or a current of air, being sufficient to excite terrible convulsions.

4. An irritation operating by reflex action is undoubtedly the occasional cause of sensorial disturbance. Pressure upon or wound of a sensitive nerve has sometimes produced extensive paralysis of sensibility; a bad tooth may notably give rise to amaurosis; vertigo, hallucinations, and illusions are now and then plainly the result of an irritation proceeding from a centripetal nerve, not perhaps felt in any other way than as it is

testified by effects which disappear with the removal of the irritation. An interesting example of severe disturbance of the nervous centres from a slight eccentric irritation is related by Dr. Brown-Séquard, to whom it was communicated by Mr. C. De Morgan. A lad, aged fourteen, as he was getting up in the morning, was heard by his father to be making a great noise in his bedroom. On the latter rushing into the room, he found his son in his shirt, violently agitated, talking incoherently, and breaking to pieces the furniture. His father caught hold of him and put him back into bed, where at once the boy became composed, but did not seem at all conscious of what he had done. On getting out of bed he had *felt something odd*, he said, but he was quite well. A surgeon who was sent for found him reading quietly, with clean tongue and cheerful countenance, and wishful to get up. He had never had epilepsy, but had enjoyed good health hitherto. He was told to get up; but on putting his feet on the floor and standing up his countenance instantly changed, the jaw became violently convulsed, and he was about to rush forward, when he was seized and pushed back on to the bed. At once he became calm again, said he had *felt odd*, but was surprised when asked what was the matter with him. He had been fishing on the previous day, and, having got his line entangled, had waded into the river to disengage it, but was not aware that he had hurt his feet in any way,—that he had even scratched them. "But on holding up the right great toe with my finger and thumb, to examine the sole of the foot, the leg was drawn up, and the muscles of the jaw were suddenly convulsed, and on letting go the toe these effects instantly ceased." There was no redness, no swelling, but on the bulb of the toe a small elevation, as if a bit of gravel, less than the head of a pin, had been pressed beneath the cuticle. On compressing this against the nail cautiously, a slight convulsion ensued; there was no pricking when pressed, but he said *something made him feel very odd.* The slightly raised part was clipped away; no gravel was found, but the strange sensation was gone, and never returned.*

The general bodily feeling which results from the sum of the different organic processes is not attended with any definite consciousness or perception of the causes that give rise to it; the organic stimuli are, in fact, organically felt, but do not in the natural state of health excite, as a stimulus to one of the special senses does, a particular state of consciousness; and when the organic stimuli do force themselves into consciousness, as happens in disease, then it is in pain that their action is felt. In respect of our organic feeling we are, in reality, on a level with those humble animals that have a general sensibility without any organs for special discrimination and comparison; and if this were the only feeling which an individual had, he would probably not know that he was an *ego.* Having no idea of the particular cause of any modification in this general feeling, we are plainly most favourably placed for the generation of illusions with regard to the cause. Consequently it is not surprising to find that the insane frequently have extravagant hallucinations and illusions respecting the cause of an abnormal sensation which is actually due to a morbid state of some internal organ; they think to interpret it as its unusual character seems to demand, and conformably with their experience of the definite perceptions of the special senses; accordingly they attribute the anomalous feeling to frogs, serpents, or other such creatures that have got into their insides.

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* *Lectures on the Physiology and Pathology of the Central Nervous System*, by Dr. Brown-Séquard, 1860. A case singularly and suspiciously like the one above related is quoted by Burrows (*Commentaries on Insanity*, p. 215) from Hufeland. A boy between thirteen and fourteen years of age suddenly began to talk in a very wild and incoherent way, and at length became ungovernable. This state was assuaged by soporifics. But the paroxysm was observed to recur whenever he was placed on his feet. On examination, a reddish spot was noticed on one foot, which, when pressed, always occasioned a fresh paroxysm. Upon an incision being made, a minute piece of glass was discovered and extracted. During the operation the patient was furious, but every symptom of violence vanished when the offending cause was removed.

5. Whether any beneficial influence is exerted upon the nutrition of the nervous centres of the sensorium commune by the centres that lie above it, must remain uncertain, though it is probable enough. No trustworthy conclusions can be drawn from experiments in which the cerebral hemispheres have been removed, for the mischief done is far too great to warrant any inference. It is certain that an area of morbid activity in the cerebral hemispheres may act injuriously upon the sensory centres and give rise to secondary derangement of their functions; but the result is then perhaps due to reflex or sympathetic action, the morbid centre acting as a morbid centre of irritation in another internal organ notably does.

In concluding this account of the sensory nervous centres, I have only to add that a review of their relations and functions does certainly establish a close analogy with the relations and functions of the spinal centres. In both cases there are nervous centres which have the power of independent reaction, though they are usually subordinated to the control of higher centres; in both cases the faculties are for the most part organised gradually in relation to outward circumstances through the plastic power of the nervous centres; and in both cases the independent power of action of the centres may, by reason of disease, be exhibited in explosive demonstration. The paroxysm of hallucination which affects the cells of the sensorium commune excites, a corresponding convulsive energy of the motor centres, and drives the furious epileptic to desperate violence, is as little within his control as is the convulsion of his limbs that is owing to disease of the spinal cord.

NOTES.

[1] (p. 194).—It ought not to be forgotten that Dr. Darwin distinguished voluntary from sensori-motor movements. "Many common actions of life are produced in a similar manner (*i.e.*, by sensation). If a fly settles on my forehead, whilst I am intent on my present occupation, I dislodge it with my finger without exciting my attention or breaking the train of my ideas."—*Zoonomia*, vol. i. p. 40. "Other muscular motions, that are frequently connected with our sensations, as those of the sphincter of the bladder and anus, and the musculi erectores penis, were originally excited into motion by irritation, for young children make water, and have other evacuations, without attention to these circumstances—'et primis etiam ab incunabulis tenduntur sæpius puerorum penes, amore nondum expergefacto. So the nipples of young women are liable to become turgid by irritation, long before they are in a situation to be excited by the pleasure of giving milk to the lips of the child."—*Ibid.* p. 38. "There is a criterion by which we may distinguish our voluntary acts or thoughts from those that are excited by our sensations. The former are always employed about the *means* to acquire pleasurable objects, or to avoid painful ones; while the latter are employed about the *possession* of those that are already in our power." And he goes on to say that the ideas and actions of brutes, like those of children are almost perpetually produced by their present pleasure or their present pains; they seldom busy themselves about the means of procuring future bliss or avoiding future misery.—*Ibid.*, vol. i. p. 184.

One of the best examples of acquired sensori-motor action is furnished by the story of the old soldier who was carrying home his Sunday dinner, when some one behind him called out suddenly in a tone of command, "Attention." Instantly he dropped his dinner and stood in the attitude of attention. Dr. Jackson tells another equally illustrative story: he was riding on an omnibus one day when, after the vehicle had stopped, one of the horses turned stupid and would not start again, notwithstanding all that the driver could do. The conductor thereupon opened the door of the omnibus and shut it with a bang, when the animal started at once.

[2] (p. 213).—In the Forty-third Report of the Massachusetts Asylum for the Blind, Dr. Howe relates the following instances of

the greater keenness to which the remaining senses may be brought when one sense is absent :—

"Julia Brace, a deaf and blind mute, a pupil of the American Asylum, had a fine physical organization and highly nervous temperament. In her blindness and stillness her main occupation was the exercise of her remaining senses of smell, touch, and taste, so that through them she might get knowledge of all that was going on around her. Smell, however, seems to be the sense on which she most relies. She smells at everything which she can bring within range of the sense ; and she has come to perceive odours utterly insensible to other persons. When she meets a person whom she has met before she instantly recognizes him by the smell of his hand, or of his glove. If it be a stranger she smells his hand, and the impression is so strong that she can recognize him long after by smelling his hand, or even his glove, if just taken off. She knows all her acquaintances by the smell of their hands. Surprising things are told of the nicety of her sense. She was employed in sorting the clothes of the pupils, after they came out of wash, and could distinguish those of each friend. If half a dozen strangers should throw, each one his glove into a hat, and they were shaken up, Julia will take one glove, smell it, then smell the hand of each person, and unerringly assign each glove to its owner. It is even said that if, among the visitors, there is a brother and sister, Julia can pick out their gloves by a certain similarity of smell, but cannot distinguish the one from the other." Does not this case furnish a strong argument in support of the conjecture that a dog removed to a distant place finds its way home by following backwards a train of smells which it has experienced ?

He gives another instance illustrating the remarkable acuteness of the sense of hearing in a blind boy :—

"Many years ago, an ingenious locksmith applied to me for the 'loan' of a blind boy, as he said, who had quick ears and a silent mouth. On giving satisfactory answers, he got his 'loan.' He wanted a boy to help him to open a new and complicated lock to a safe. An inventor had exhibited a locked safe and the key, saying that there was money within, which should be given to whoever could open the lock without deranging it. The peculiarity of the lock was that it had ten bolts which could not be seen from the outside. These ten bolts seemed, from all that could be ascertained, exactly alike ; but, in reality, one of them was an inch longer than the others, so that when all were thrown forward, that one alone reached the projecting part of the safe, and held the door closed. The key, when inserted, would lift any of the ten bolts ; but, in order to open the safe, it must be applied to the long bolt, and to that only, and that one must be lifted and turned back, in order to open the lock. But, if any other of the ten were lifted and turned back, ever so little, it deranged the combination, and the lock could only be opened by a peculiar instrument. The object, then, was to ascertain which of the ten was thrown forward, without turning back any other one.

"The mechanic lifted each bolt carefully with the key, and let it fall, but without trying to throw it back; and he then tried to ascertain if in falling it made any peculiar noise; for he inferred that, as the on'y one which held the door was an inch longer than the others, it must fall with a slightly greater force. But the difference was too slight for his ear. He took the blind lad, and asked him to listen carefully to the sound which each bolt made as he lifted it and let it fall. After listening to each one intently, the lad said the sixth one struck a little the loudest. The mechanic lifted and let fall each one carefully several times, and each time the boy insisted that the sixth bolt sounded the loudest. Upon this, the mechanic lifted and turned back the sixth, and the lock was opened without the combination being deranged."

[3] (p. 236).—"ALCIPHRON:—If vision be only a language speaking to the eyes, it may be asked, when did men learn this language? To acquire the knowledge of so many signs as go to the making up a language, is a work of some difficulty. But will any man say he hath spent time, or been at pains, to learn this language of vision?

"EUPHRANOR:—No wonder we cannot assign a time beyond our remotest memory. If we have been all practising this language, ever since our first entrance into the world: if the author of nature constantly speaks to the eyes of all mankind, even in their earliest infancy, whenever their eyes are open in the light, whether alone or in company: it doth not seem to me at all strange that men should not be aware they had ever learned a language, begun so early, and practised so constantly, as this of vision. And if we also consider that it is the same throughout the whole world, and, not like other languages, differing in different places, it will not seem unaccountable that men should mistake the connexion between the proper objects of sight and the things signified by them to be founded in necessary relation, or likeness, or that they should even take them for the same things. Hence it seems easy to conceive, why men who do not think should confound in this language of vision the signs with the things signified, otherwise than they are wont to do in the various particular languages formed by the several nations of men."
—BISHOP BERKELEY'S *Minute Philosopher*, vol. i. p. 231. Ed. 1732.

CHAPTER V.

HEMISPHERICAL GANGLIA; CORTICAL CELLS OF THE CEREBRAL HEMISPHERES; IDEATIONAL NERVOUS CENTRES; PRIMARY OR SUPREME NERVOUS CENTRES; INTELLECTORIUM COMMUNE.*

By the study of physiology it has been placed beyond doubt that the nerve-cells which exist in countless numbers—about 600 millions in number, according to Meynert's calculations—in the grey matter spread over the surface of the hemispheres are the nervous centres of ideas. The cerebral hemispheres represent, in reality, two large ganglia that lie above the sensory and motor centres, and are connected with them by a multitude of nerve-fibres, described by Reil as the fibres of the internal sense; they are superadded in man and the higher animals for the further fashioning of sensory impressions into ideas or conceptions.

This important step in the evolution of the human mind consists in an abstraction of the essential from the particular and its re-embodiment in idea; it is in fact an *idealisation* of the sensory impressions, and may be regarded as an epigenetic development of nature: what the true artist does in his art nature does continually in the development of the human mind. Looking not at the individual man and his work as the end, but looking at him as a small and subordinate part of the vast and harmonious whole, as a means to a far-off end, it is sufficiently evident that the history of mankind is the history of the latest and highest organic development; that in the evolution of the human mind nature is undergoing its consummate development through man. And the law manifest in this highest display of organic development is still that law of progressive specialisation and increasing complexity which has been traceable through the long chain of organic beings. So exquisitely delicate, however, are the organic processes of mental development which take place in the nerve-centres of the cortical layers, that they are certainly, so far as our present means of investigation reach, quite impenetrable to the senses; the mysteries of their secret operations cannot be unravelled; they are like nebulæ which no telescope can yet resolve. Nor will it be thought reasonable to ask such knowledge, when we reflect that we have not yet the means of knowing the properties and structure of the molecule of any liquid or solid—what are its internal motions and what are the parts and shape of it; and that it would require a microscope capable of magnifying from 12,000 to 16,000 times to show the molecular structure of water.*

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* "We have not a name for that complex notion which embraces as one whole all the different phenomena to which the term Idea relates. As we say Sensation, we might say also Ideation; it would be a very useful word; and there is no objection to it, except the pedantic habit of decrying a new term."—JAMES MILL, *Analysis of the Human Mind*, p. 42.

The cerebral hemispheres are not alone the nerve centres of ideas, but they are also the centres of emotion and volition. In animals that are deprived of their hemispheres, all trace of spontaneity or will disappears from their movements; this effect being, as might be expected, much more evident in experiments on the higher than on the lower Vertebrata. In Fishes, as for example in the carp, scarcely any difference is observed in its swimming after its hemispheres have been removed; but if its movements be watched more carefully, and compared with those of a carp which has not been mutilated, a certain change will be recognised. According to Vulpian, it moves forward in a straight line, never turning to one side or the other except when it meets with an obstacle, and not stopping until it is completely fatigued; it seems impelled to move by some necessity, a necessity occasioned probably by the stimulus of the water on its body. The more marked effects produced in the higher Vertebrata by the removal of the hemispheres have already been described.

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* According to Sir W. Thomson's calculations, the distance between two molecules of water is such that there are between five hundred millions and five thousand millions of them in an inch.

It has long been surmised that different convolutions of the brain discharge different functions in the mental life, and the phrenologists, by inferring organ from function, went so far as to precisely map out the cerebral surface into definite regions and to assign its particular mental faculty to each region. The localisation which they made has not been borne out by anatomical research, nor do the faculties which they assume receive adequate support from psychological analysis. That the high, broad, and prominent forehead marked intellectual power, was a belief which the ancient Greeks entertained, and which has long been popularly held; and the notion that lowness and narrowness of the forehead indicate intellectual inferiority is in harmony with the observations that in the negro, and more markedly in the Bosjesman, the anterior part of the hemispheres is narrower than in Europeans, and that the narrowing of the frontal lobes to a point is one character by which the brain of the monkey differs from that of man. It has been conjectured also that the upper part of the brain and the posterior lobes have more to do with feeling than with the understanding; Huschke found them to have a proportionately greater development in women than in men; and Schroeder van der Kolk's pathological researches afforded him what he considered convincing proofs that the anterior lobes of the brain were the seat of the higher intellectual faculties, and that the upper and posterior lobes ministered rather to the emotional life.

Comte elaborated a phrenological scheme which was a modification of that put forth by Gall, holding confidently that from the study of cerebral functions it was possible to determine the number of cerebral organs and their relative position. But the details of his scheme will hardly strengthen the authority of his method. Regarding the brain as forming an anatomical connection between the two external mechanisms of sensory and of motor nerves, as it manifestly does, he surmised that the arrangement of the two parts of the central apparatus would be adjusted to these two extreme terms in the system, and was led to place the intellectual organs in front, as being more connected with the various mechanisms of sensations. The rest of the brain was appropriated by him to affective functions, which were placed backwards because of their connection with the principal mechanisms of motion; the centres of intellectual operations, which do not of themselves lead to motion, being more remote from its mechanism. The cerebral functions were supposed to be higher in quality and inferior in force as we proceed from behind forwards; and in conformity with this view the anterior part of the affective region was appropriated to the social or altruistic feelings, which were thus in proximity to the intellectual organs, the hinder part being reserved for the less noble personal or egoistic propensities.

In consequence of pathological observations it was insisted by Dr. Todd, contrary to general opinion at that time, that the seat of the convulsive phenomena of epilepsy was in the cerebral lobes, but this theory found no favour, because of the general belief that the grey matter was insensible to stimulation and had nothing to do with movements. Nevertheless the observations of Dr. Wilks led him subsequently to a decided conviction of the correctness of Dr. Todd's opinion; he had no hesitation in saying that for one case of disease in the pons varolii with epilepsy, fifty cases might be found in which the morbid changes were on the surface of the brain; and he could not see any grounds for the theory that the seat of epilepsy was in the pons or in the central ganglia of the brain. He felt sure that the *fons et origo mali* was in the cortical layers of the brain, and that improved methods of examination would disclose morbid changes there in cases of long-standing epilepsy.* Before this, Broca had propounded a theory that the seat of articulate language was in the posterior part of the third convolution of the left side of the brain, founding it upon certain pathological observations in which loss of speech was accompanied by destruction thereof; and the theory, though it seemed startling and improbable to many persons, had received competent support. Dr. Hughlings Jackson next made a conjectural step farther in our knowledge of epilepsy; noticing that the convulsive phenomena often commenced in certain muscles, different in different cases, and then spread to the whole body, he inferred that the commencement of the morbid irritation which led to the epileptic discharge was in the special convolutions presiding over the group of muscles first affected, and that it afterwards spread to the other convolutions. He ventured even in some instances to fix upon the special convolution which was presumably at fault.

Such, until quite recently, was all that was known or conjectured concerning the functions of the different cerebral convolutions. There was great difficulty in the way of acquiring more exact knowledge by means of physiological experiments on animals and pathological observations of man, the difficulty being much increased by the fact that the hemispheres have a compensating action; for it has been observed that a pigeon which has had one hemisphere or considerable portions of both hemispheres removed does not, after a few days or weeks, present any notable differences from an uninjured bird. In man, too, not only may there be considerable destruction of a portion of one hemisphere by disease without any disturbance of intelligence, the disturbance, if any, being more often motor than mental, but there may be a total destruction of one hemisphere without any appreciable impairment of mental function. The probable explanation of these facts is that different parts of the cortical area replace one another in function in a singularly complete manner, so that a disturbance of function produced at first by sudden injury or disease gradually disappears more or less completely. This vicarious action will appear the less surprising when we call to mind the infinite multitude of nerve-cells that exist in the grey matter of the hemispheres, the great majority of which are probably never used in our ordinary mental functions. In fact, just as one spermatozoon suffices for impregnation, while thousands are produced only to go to waste, so it may be that a comparatively small number of the multitude of nerve-cells which are secreted in the brain are engaged in mental function, while thousands come and go without being called upon to perform any function under ordinary circumstances. A profuse and reckless waste of life is in the regular course of nature's operations.

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* "Observations on the Pathology of Diseases of the Nervous System." *Guy's Hospital Reports.*

Recent physiological experiments on animals have at length thrown some light upon the functions of the cerebral convolutions. Instead of being insensible to all kinds of stimuli as was so long supposed, Fritsch and Hitzig discovered that the application of a weak galvanic stimulus to the cortical layer excited movements; they observed furthermore that these movements were of a definite co-ordinate character, and might be uniformly excited by stimulating particular convolutions. Not all the convolutions thus reacted, for stimulation of some was followed by no external phenomena whatever; but in those which did react to the stimulus the results were so definite and uniform that they might be predicted. Similar experiments have been made in this country by Dr. Ferrier, who made use of the more intense Faradic current of an induction coil; the results of which were to confirm and extend the observations of Fritsch and Hitzig.* It has been objected to these experiments that the electric currents are conducted from the surface of the brain to the motor centres in the ganglia beneath, and that the results do not therefore prove that there are motor centres in the cortical layers. An obvious answer to this objection was that motor phenomena are not produced by stimulation of all the convolutions, not even by stimulation of some which lie in much closer relation to the corpora striata than those which do respond to the stimulus, and that the stimulation of closely adjacent regions is followed by uniform results of a very different character.

Moreover, it has been shown by Nothnagel and others that the removal of the centres, the stimulation of which produces certain co-ordinate movements, is followed by paralysis of these movements. If the cortical area forming the presumed centre be not entirely removed, but only separated carefully from the parts beneath, so as to form a flap, and if the stimulus be applied when the flap is in position no motor result follows, showing that there is no conduction; if the flap be turned back, and the fibres beneath be stimulated, the definite movement follows. Dr. Burdon Sanderson had observed that after complete removal of the supposed cortical centres of a group of movements these might still be excited by stimulation of the white fibres beneath, by which the removed centres had been connected with the corpora striata; and quite recently he has succeeded in some instances, by fixing the points in the corpus striatum corresponding to the supposed cortical motor centres and applying the stimulus to them, in exciting the same definite movements as are produced by stimulation of the cortical areas.

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* A complete account of these experiments is given in *Untersuchungen über das Gehirn*, von Dr. E. Hitzig, Berlin, 1874. But the first paper on the subject appeared in Du Bois Reymond's *Archiv*, Heft 3, 1870. Dr. Hitzig severely criticises Dr. Ferrier, and roundly charges him with "adorning his work, without acknowledgment, with discoveries which belong not to him, but to us." Dr. Ferrier's experiments are recorded in the *West Riding Asylum Reports*, vol. viii. p. 52, 1873.

These experiments are quite in accordance with the opinion that the actual co-ordination of movements is effected in the motor ganglia, and with the observed phenomena of sensori-motor action, but they are also consistent with the theory that there are in the cortical layers higher centres which are differentiated by their special connections with the co-ordinating centres below and minister to voluntary movements—which supply us with the mental presentations, so to speak, of the movements. No doubt were our senses acute enough, and our instruments delicate enough, to limit the application of a stimulus to the special centre of co-ordination in the subordinate motor ganglia in all cases, we might always produce exactly the same definite movements as we do when we apply the stimulus to the higher cortical centres, but as things are, we certainly should not fail, in most instances, to excite a great many more centres in the motor ganglion if we were to make the attempt.

The conclusion then which we are warranted in drawing from the experiments is that there are in the cortical layers of the hemispheres motor areas which are differentiated by having their definite connections with the different co-ordinating centres in the subordinate motor ganglia.

The question is, what is the actual function of these cerebral motor areas? Fritsch and Hitzig reject the idea of an actual paralysis being produced by the extirpation of one of the centres; believing the apparent paralytic phenomena to be due to a disturbance or destruction of the muscular feelings of the special movements. They fairly claim to have shown experimentally that those parts of the cerebral cortex, of which stimulation produces movements, and which act therefore as motor centres, are the seat of muscular feeling, of the conception of the measure and kind of the muscular innervation, or, in other words, of the so-called muscular intuitions. The sensory and motor ganglia notably suffice to perform all forms of movement in a purely reflex manner after the removal of the hemispheres; when the hemispheres are present, however, the impressions of such reflex acts are carried centripetally to the cortical centres, where they are, as it were, echoed or repeated, and the feeling of their innervation takes place, and so it comes to pass that the motor intuitions are formed which afterwards take their part in the conscious movements of the will. This conclusion from experiment harmonizes well with what I have always maintained that psychological analysis teaches us concerning the nature of the motor intuitions and the essential part which they play in our mental life.*

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* In the first edition of this book, there was a chapter on "mo'or intuitions" which attracted no attention; the argument of which was that while the immediate agents of definite movements were the motor ganglia, these, when active, had definite functional relations with the superordinate cerebral centres, in consequence of which they produced the motor intuitions in the latter.

The convolutions which respond to stimulation by giving rise to movements are in the anterior portion of the brain; no motor effect is produced by stimulation of the convolutions of the posterior lobes. It has been surmised that the posterior convolutions are the seat of sensorial perceptions, for while the motor tract of the cerebral peduncles terminates principally in the cortex of its frontal part, some of the nerves of sense have been traced to the posterior convolutions, while others are presumed to end there. Moreover, a resemblance in some respects has been observed between the structure of some of these convolutions and that which is met with principally in parts that minister to sensation, to wit, the retina, the olfactory lobes, the nucleus of the fifth nerve, and the gelatinous substance of the posterior cornu of the spinal cord. Lastly, the results of experiments on animals, so far as they are definite and can be relied upon, are in favour of this supposition.* It would appear then that in the frontal part of the convolutions are contained the residua of the feelings of movements, from which we derive our so-called motor intuitions, and that in the posterior part of the convolutions are contained the residua of the sensory perceptions, from which the sensory elements in ideas are obtained.

Here then we have disclosed to us the path of a psychical reflex act. The activity excited in the posterior convolutions passes to the anterior convolutions and there gets expression in the appropriate movement or speech. It is the simplest type of a mental process. We have reached in fact the higher ideo-motor or percepto-motor arc, which is spread above or overarches the sensori-motor arc; perception answering to the afferent impression, and the efferent effect being the issue of the idea in movements. We may conceive the hemispheres to be formed of a multitude of such arcs which are interconnected in so many ways through junction-cells as to form a number of inconceivably intricate plexuses, such complication of structure producing corresponding mental complexity; wherefore it must almost always happen, after mind has been developed, that many associated sensory residua and many associated motor residua, joining forces with or antagonizing one another, are simultaneously or successively excited by a stimulus. Although movement may be looked upon as the outgoing energy of which sensation is the incoming supply, the expenditure of what has been gathered in, yet so many perceptions have been capitalized in the convolutions and may be drawn upon when a demand is made, that the outgoing current represents, not merely a reflected energy, but a motor effect which is charged with the gains of past experiences, that is to say, is enlightened by reason.

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* The supposition has been recently strengthened by the results of numerous experiments which Dr. Ferrier has made upon the brains of monkeys. The briefest notices of these results have appeared in one or other of the medical journals, but I am not aware that any detailed description of the experiments has yet been published.

It may be asked, what is the nature of the ideas that are formed in perception? Are they impressions traced upon the brain, as Haller argued, or are they of the nature of minute vibrations or oscillations—currents of molecular activity, along different nervous paths, as Bonnet ingeniously surmised? [*] It is easy to under-

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[*] "La faculté par laquelle les représentations s'opèrent est l'imagination, mais les ideés sont attachés aux mouvements des fibres sensibles. Pour qu'une idée se presente de nouveaux à l'âme, il faut donc que les fibres appropriées à cette idée soient mues de nouveau. La disposition du cerveau à répéter ces mouvements constitue donc l'imagination."—BONNET, *Essai de Psych.*

"Objections made to this opinion show how necessary to a knowledge of psychology is a thorough knowledge of physics and physiology. It is said that the fibres are not capable of the tension and stand that the occurrence of such vibrations along a nerve track on one occasion would render the delicately organized matter more apt to fall into similar vibrations on another occasion; it has undergone a certain modification in consequence of its excitation, and it will the more readily give back the same note, so to speak, or fall into the same rate of vibration, when it is again stimulated suitably, just as the stretched string of a piano, when several notes are sung in the room, will give back the note belonging to it. When we speak of a trace, vestige or residuum, all we mean to imply is that an effect is left behind in the organic element, a something retained by it, which disposes it to a similar functional act; a disposition has been acquired which differentiates it henceforth, although we have no reason to think that there was any original specific difference between one nerve-cell and another. When we are conscious of this revival of the past, we say that we remember it; but when it takes place, as it does every minute of our lives, without consciousness, then we have no proper name for it. What are we to call this mental correlative of a nervous process which affects us not consciously? Those who would call it memory are charged with gross philosophical absurdity or with a

relaxation which more rapid and forcible vibrations, or those which are slower and feebler, would require. As if the fibres were supposed to vibrate in their places like strings! Then again, that they are not sufficiently numerous to answer to the myriads of millions of states of thought and feeling which are represented in memory and in the fancy. Again, it is objected, the theory, if complete and adequate in every other particular, would fail entirely to account for the creative energy of the imagination. Let it be granted that it did so fail, it might not be an entirely unprofitable failure, if it moved psychologists to reflect how little they account for by contentedly using the word imagination to do duty for actual knowledge, and helped them to realise what a quantity of ignorance they hide under its use."—*The Human Intellect.* Noah Porter, D.D. (p. 273.)

glaring contradiction of terms. Memory, it is said, implies consciousness, and the term 'unconscious memory' is self-annihilating. So be it, if it is insisted that memory shall only be used in this restricted sense, only we must be careful not to let such use of the word blind us to the facts: we ought to take heed that we do not lose grasp of the important and incontestible fact that the physiological process of retention is something which lies beneath memory, which takes place unconsciously, and which is the physical basis of memory and of every other mental function. Believing then with Bonnet that ideas are insensible motions of nerve-molecules, of the nature of vibrations, or, as Hartley called them, vibriatuncles, we may grant that in Haller's description of them as impressions made upon the brain there was a just recognition of this important physiological process of retention.

Ideas which arise from perception are naturally more vivid than when they are excited by internal causes—ideas of presentation than ideas of representation—because the motions are more easily and actively excited in the way they were first and are habitually excited, and because when excited by external causes, there is a vivid presentation of the sensory as well as of the motor element of the idea, which therefore occupies the attention more exclusively; but if intense attention be given to them when internally aroused, they may be made more active, the sensory element being excited by reaction of energy upon its centre, and may sometimes become so vivid as to generate actual hallucinations. Just as the expression of an emotion by its suitable gesture will excite or increase the emotion, causing it to fill the field of conscious vision, or, in other words, to engage the whole attention, so the internal repetition or actual utterance of the word which is the symbol of an idea reacts upon the perceptive centre of it and makes more vivid, through this sensory representation, the conception of what it represents. We are only describing the same facts in different terms when we say that we are directing attention to it.

In the foregoing chapter it was pointed out that a perception groups or organizes several sensations into one idea. Once the idea of the object has been thus acquired, any one of the different sensations of which it is constituted may suffice to arouse it; it may be apprehended through sight, or touch, or perhaps taste or smell, not otherwise than as it may be apprehended through the written word after we have learnt to read: the sensation, like the word, is a symbol which serves to excite it. Our perceptions are really a language that we have been learning all our lives, and we no more perceive by a single sense the actual object, as we apprehend it in idea, than we perceive the actual object in the artificial word or sign which has been used to denote it. Seeing alone, or smelling alone, for instance, would not impart any definite notion of the properties of an external object; it could impart nothing more than its special sensation until a definite knowledge of the existence and nature of the object had been acquired by association of the sensation with the experiences of other senses, that is, by experience and observation. The impressions of its different qualities or properties received through the different senses are combined in the idea of it, and thenceforth we can think and reason about it abstractly through the idea when it is not present to any sense. This abstraction is made essentially easier by the fact that the object may be apprehended through different senses; not being inseparably linked to any one sensory impression, it is more easily thought about abstractly from all sensation. The idea in fact is organised as a separate mental existence in the cerebral convolutions, being for us, when so organised, to all intents and purposes the object, and may be aroused into independent activity. Every idea is thus representative, the abstract of many sensations, comprising implicitly more than it displays explicitly; in it the essential is embodied, the unessential suppressed or rejected; it is not the idea of any particular object or event, but the idea of every object or event of a particular kind; it is fundamentally a generalisation or induction. We may justly say, then, that the ideational nerve centres *idealise* or *ideate* our sensory perceptions; the process of ideation, like other processes of organic evolution, being one of progressive differentiation and integration,—of discrimination of the unlike and assimilation of the like.

As mental development proceeds we get not only more ideas, but ideas which are more and more abstract. From the idea of a concrete man we rise to the general idea of man, and from the general idea again we rise in ascending abstraction to the abstract idea or concept of benevolence, virtue, or other quality as belonging to man. As a percept is the abstract of sensations, so a concept is the abstract of percepts. It may be conjectured—but it is a conjecture only—that the superimposed layers of cells and fibres, of which the convolutions consist, answer to these increasing complexities of ascending abstraction; the lowest layer being concerned in concrete perception, the highest layer ministering to the most abstract thought. No animal, so far as we can judge, is capable of forming an abstract idea any more than a young child is, although there is good reason to think that the more intelligent animals are able to form a few general ideas; a dog, for example, plainly having not only an idea of a particular man, such as its master, but a general idea of man apart from any particular man, and being probably capable of conveying that idea to another dog. Savages occupy an intermediate position between animals and civilised men in this respect. The vocabulary of many savages, which we may study profitably in order to ascertain what thoughts they have, is very limited, often containing only such phrases as are required to describe the most striking objects of nature, and those which enter into the daily life of the people. They have no abstract terms. In the North American languages a term sufficiently general to denote an oak-tree is exceptional; the Chocktaw language has names for the black oak, white oak, and red oak, but no generic name for an oak.* The Tasmanians, again, had no general term for a tree, though they had names for each particular kind of tree; and no abstract words to express qualities, instead of hard, saying "stone-like," instead of round "moon-like," instead of high "with long legs."† The Bushmen, according to Lichenstein, could not count beyond two, and many other savages cannot count beyond five. The language of the Friendly Islanders is said to contain no words expressive of the higher qualities of human nature, such as virtue, justice, humanity, or of their opposites, vice, injustice, cruelty; this is true also of the languages of the Native Australians and other savages. The Bongos of Central Africa have no words for the most common of our abstract ideas, such as spirit, hope, fear; the words are absolutely wanting; and experience shows that in this respect other negro tongues are not any better provided.‡ The Algonquin language, one of the richest in North America, contained no verb "to love," and when Elliot translated the Bible into Algonquin in 1661, he was obliged to coin a word to express what was wanted.

It is plain then from these examples that savages represent a much lower degree of mental development than civilised nations; they are like children, who cannot understand abstractions, and must be instructed through sensible objects or pictures. The distance between animals and savages is undoubtedly far greater than that between savages and civilised people; of the most intelligent animals only can we believe that they are capable of forming a few general ideas; and we may venture to assume that no animal ever possesses an abstract idea. This destitution is closely connected with the absence of articulate language; for as there are no actual objects, no external realities, corresponding to generalizations, some sort of language is necessary, taking the form either of sound to the ear or of symbol to the eye, to fix the generalisations in order that they may be objects for future revival and use. Now it is plain that animals are without these necessary signs or symbols. Wanting verbal language, they want the signs by which to denote and express such ideas, but it would be an error to suppose that they are only destitute of abstract ideas because they have not language; constituted as their brains are they would not have the capacity of abstract ideas, even if they had some capacity of language, because their brains have not the complication of nervous structure which is necessary to subserve such ideas; and it is probable that, were they possessed of abstract ideas, these would not fail to enforce some means of expression, and that language would thus develop with the development of their minds.

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* *On the Origin of Civilisation.* By Sir John Lubbock.

† *Volkerkunde.* Von Oscar Peschel, p. 116.

‡ Schweinfurth's *Heart of Africa*, p. 311.

It is important to take notice of the nature of this process of mental development through ascending degrees of abstraction, in order to estimate the true value or meaning of an abstraction. This must always be sought in the concrete, by resolving the higher abstractions into lower abstractions, and these into the concrete. Had this searching method been pursued, instead of the opposite method of finding the meaning of the concrete in the abstract, many metaphysical entities would have died at their birth, and much vain and empty metaphysical discussion would have been spared to the world. It is instructive to take note how, when we consider the nature and origin of the language in which we express our intellectual processes and our feelings, we are perforce brought back to the senses and movements—that is, to our means of actual contact with nature. "I see it," is commonly used to mean "I comprehend it," and in a similar sense we speak of the eyes of our understanding being opened. In like manner we *grasp* or *apprehend* an argument, *feel* a truth, have our feelings *touched*, *disrelish* or *recoil from* a proposal, are *disgusted* with a person's conduct. The French say *Je goûte cela* in an intellectual sense, and with them *J'entends cela* means either "I hear that," or "I understand that." It is the same with other languages. The highest intellectual products betray their foundations in sense and movement by the terms which are used to denominate them.

Those who are metaphysically-minded have done with idea as they have done with sensation; they have converted a complex notion or general term, summing up a great number of varied phenomena, into an actual entity, and thenceforth allowed it to tyrannize over the thoughts. It is a great and mischievous error to suppose that an idea of the same object or event has always a uniform quantitative and qualitative value; and the way in which it is the custom to speak of certain abstract ideas, as if they were constant entities admitting of no variation, nor of the shadow of a change, is a remarkable example of that self-deception by which man fondly fools himself, "with many words making nothing understood." An idea may be definite, clear, and adequate, or it may be indefinite, obscure, and inadequate; it by no means follows, therefore, that because the same name is given to an idea in two persons, it has the same value in each. The meaning which a child attaches to a particular word varies according to its experience, being enlarged or reduced by new experiences, until it becomes precise and adequate.* Certain ideas will always have a different value in persons at a different stage of cultivation. When the well-meaning traveller or the ardent missionary thinks to find in the miserable savage the idea of a God, he should take heed that he is not erroneously interpreting the savage mind by the text of his; and he might do well to be at the pains to define the idea which he supposes himself to have. The ideas of virtue and vice, for which the Australian savage confessedly has no words in his language, cannot be implanted or organised in his mind, until, by cultivation continued through generations, he has been humanised and civilised. (1) Within historical and comparatively recent time such words as liberty, honour, right, and the like, have gradually undergone perceptible changes in meaning, and it is probable that they may continue to do so in the time to come; for words, like creeds and laws, grow, change, decay, and die. Ancestral nervous substrata gradually become obsolete, as instincts in animals gradually become extinct, and new substrata are formed, as new instincts are developed in animals, with changed conditions through ages.

To acquire those so-called fundamental ideas, universal intuitions, or categories of the understanding, of which some metaphysicians make so much, as constant elements, though they differ greatly in value in different people, there is no other need but, using Hobbes' words, "to be born a man, and live with the use of his five senses." (2) Because all men have a common nature, have the same number and kind of external senses, and because the nature by which all men are surrounded is the same, therefore are developed certain ideas which have a universal application, but they are nowise independent of experience; on the contrary, the universality of their character is owing to the very fact that in every experience they are implicitly suggested or involved, so that they finally become fixed as endowments in the acquired nature or organisation of the nervous centres; conscious acquisition becoming here, as elsewhere, unconscious faculty, by virtue of an organic process. But their absolute truth, as expressions of certain fundamental relations between man and nature, is only guaranteed by the assumption of an unchanging persistence of these relations; a new sense conferred upon him would entirely change the aspect of things, and render necessary a new order of fundamental ideas.(3)

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* Beneke lays down the proposition "dass unter millionen Auffassungen desselben Gegenstandes auch nicht zwei einander gleich sind." *Pragmatische Psychologie*, p. 170.

As it is with the faculties of the spinal and the sensory centres, so it is with the faculties of the ideational centres: they are not innate, but are developed by education. The notion of *innate* idea, in the exact meaning of the word, as connatural, or contemporary with birth, is not less untenable and absurd than an innate pregnancy.(4) But if by innate is only meant that, by the necessity of his nature, an individual whose brain is well-constituted will, when placed in certain circumstances, acquire certain ideas, then all the phenomena of a man's life, bodily and mental, are just as innate or natural. A civilised person certainly inherits, by virtue of being born of civilised parents in a civilised country, a predisposition to certain modes of conception and feeling, just as he inherits a predisposition to certain modes of perception or walking; in other words, he inherits certain cerebral substrata which are ready to come into functional action on occasions of their suitable stimuli at the proper periods of life. He can no more help conceiving of his experiences in a certain way than he can help perceiving an object in a certain way when he sees it, or than he can help feeling in a certain way when his reproductive organs come into functional action and arouse their cerebral representative substrata.

It is necessary in fact to distinguish between what is predetermined by the nature of cerebral structure, as the so-called innate ideas are, and what is preformed, as they are not. The formation of an idea is an organic evolution in the appropriate nervous centres, which is gradually completed in consequence of successive experiences of a like kind. For our ideas of the size of objects, of their solidity, of their distance, and of their relations in space, we are dependent upon the movements of the eyes, and in so far as these movements presuppose an inborn mechanism by which they are performed, as they certainly do, we may properly say that the individual has an inborn aptitude or capacity to have such ideas. Man, whose cerebral convolutions are larger, more complex, and less symmetrical than those of the monkey, has in like manner an innate capacity of acquiring ideas which the monkey can never acquire, because he has the nervous substrata necessary to such functions. If he was made in the image of the ape, he is assuredly now born in the image of something higher than the ape. He is born with certain aptitudes which he has inherited in consequence of ancestral accumulations, is the heir of ages of acquisition, and so he learns to reason as he learns to see or to walk: when certain experiences are made through the effects of his social and physical surroundings, they result in certain developments, which could not be otherwise under the existing internal and external conditions. As the human brain is constituted, it cannot, when certain facts are apprehended, help forming certain conclusions concerning them, the conclusion being as involuntary and irresistible as the instinct of an animal; as Wundt has remarked, the inner sense apprehends as a logical necessity what outer sense perceives as mechanical connection, that which is given to us by psychological analysis as a logical conclusion being revealed to us by physiological analysis as physical effect.

What is the mechanism of ideation, and what is the nature of the nervous action which is its physical basis, must for the present be entirely conjectural. It can hardly be doubted that there is a differentiation of parts in the grey matter of the convolutions, corresponding to differences of function, and that the cortical layers thus consist of a multitude of distinct mind-centres, so to speak, spread out in a sort of vault over the subordinate centres with which they are connected, directly or indirectly, by intercommunicating fibres, and spread out perhaps also over one another in superimposed layers. It is furthermore extremely probable that each sense has its special aggregate or grouping of cells in the convolutions, an area differentiated by its connections with the sensory ganglion beneath, which constitutes its perceptive centre, and has towards it, on the afferent side, the same relation which the motor areas in the anterior convolutions have towards the subordinate motor ganglia on the efferent side. Could we remove or extirpate exactly in any animal the perceptive centre of any one sense, we should eliminate from its perceptions of an object all those qualities thereof with which this sense was adapted to bring it into relation. But, as has been pointed out, a percept is a product of the combined action of more senses than one; we must necessarily assume, therefore, the associated action of the perceptive centres of these other senses.

Perhaps the most fit conception which we can form of the mechanism of the operation of ideation is that of a nervous circuit connecting a cell or a group of cells of each perceptive centre; a current of molecular action passing along this circuit would be the percept or idea of the object, and the current would naturally be excited at any point of the circuit to which the suitable stimulus could be applied. Obviously, however, the only points at which this could take place would be the cell-junctions, or the stations, so to speak, formed by the cell or group of cells of the respective perceptive centres included in the circuit. Herein then lies the physical interpretation of the psychological fact that the idea of an object may be aroused by any one of the sensations of which it is formed. Furthermore, when an idea is thus aroused through one sense, the perceptions of the other associated senses being understood or not realised, we may conceive that there is only a subactive state of their cell-junctions, which may be supposed to act as continuations of the nervous circuit, rather than in the perceptive or receptive capacity in which they may act when aroused into more intense activity by a stronger stimulus: we may regard them in the light of stations on the track through which quick trains pass without stopping, but at which other trains stop to take in passengers, and at which any train may be stopped if necessary. The supposition is in entire accordance with what we know concerning the regular process of conversion of nervous actions which were at first conscious into actions that are purely automatic.

When we rise from the percept to the concept, from the abstract of sensations to the abstract of perceptions, from representation to the representation of representations, by combining into one general idea that which is common to several ideas and rejecting that which is different in them, it will be necessary to imagine more complex groupings of nerve circuits. We may imagine a higher and more complex circuit in which the nerve circuits of the simple ideas now act as simple component units, taking the place in this circuit which the cell-junctions of the perceptive centres have in the nerve circuit of the simple idea; the current of activity in the higher circuit will then be aroused by any one of these associated simple circuits, just as the current of activity in the simple circuit is aroused by any one of the associated perceptive centres, and may become, like it, after several repetitions of function, automatic. In it the representatives are, so to speak, re-represented. Multiplying these interconnected plexuses in accordance with the multiplication of our ideas, and associating them, as we must do, with corresponding motor plexuses in the anterior convolutions, we perceive the necessity of the infinitely complex mechanism of cells and fibres which form the cortical layers of the hemispheres. They constitute such a complex structure as the complex mental functions must needs have; for simple structures are capable only of simple functions. We may perceive also the reason of the necessity, if we would know the real value or meaning of the most abstract ideas, of seeking for it in the concrete; we must pass from the higher nerve-circuit to the lower nerve-circuits of which it is representative, and from these again to the respective perceptive centres which they co-ordinate. If the abstract idea be not truly representative of the percept, and if the percept be not a just representation of the object, it is certain that we run great danger of losing ourselves in mazes of vague and erroneous reasoning.

It is well known how difficult a business it is to observe an object or event accurately when we have a preconceived idea of it; the ideational current answers to, or, as it were, assimilates that which is like in the perception, and becomes more active in consequence; there is no reception or assimilation of that which is unlike in it, which is overlooked altogether, or at any rate not adequately registered; and the result is that the induction, which the perception really is, and the subsequent inductions of the higher mental processes are unsound. Most part of a perception is inference, for it is only when the mind actively co-operates after several experiences that it is adequate: and whether the inference be true or false will depend on the care which we have previously taken in observation to build it up soundly, and on the care we now take, by proper attention to the object, to excite the right ideational current, if previous similar experience has furnished us with one; and if not, to appropriate a new nerve-circuit to the registration of that in the perception wherein it differs from former perceptions. The foundation of right reasoning is accurate perception.*

How far men may go in vain reasonings about empty abstractions, when they abandon observation and divorce themselves from fact, refusing to bring their abstractions to the test of experiment, the records of mental philosophy yield abundant and instructive illustrations. The theory of mind as a spiritual entity, which, having an existence independent of the body, uses this as its instrument, owes its origin, as other metaphysical entities have owed their origin, to this tendency to convert abstractions into entities. Certainly, if I could perceive and measure the intimate and imperceptible currents of thought of another person's brain, as men may learn to do in time to come, they would be objective realities to me; but that is a very different thing from what metaphysicians have made of them; and the only question for me would be whether they were as adequately representative—immediately through presentation, or mediately through representation of representations—of the individual's surroundings as his brain-mechanism was capable of making them: the same question, in fact, as I should be required to consider if I were observing in a similar way the brain-currents of an ape or a frog, or if, being an accomplished musician, I were watching another person's musical performance in order to mark whether he brought out fully the capacities of the instrument on which he was playing.

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* It may be remarked by the way that two different classes of intellect are marked by the relative predominance of the assimilative or of the discriminative power: the superiority of one sort of intellect being shown by the way in which it discovers slight and delicate resemblances or analogies which are imperceptible to other minds, and in the variety and wealth of the language by which it expresses them; the other sort of intellect being distinguished by its capacity of recognising and recording points of difference which other minds fail to observe. It is obvious that the just union of both these faculties is necessary to the best observation and reasoning: they lie at the foundations of the *method of agreement* and the *method of difference* in formal reasoning.

There is a question the answer to which one ought perhaps to endeavour to make more clear than it has been made thus far—namely, Of what precise part or process in a reflex cerebral function is idea the mental correlate? There is the sensory impression; there is the motor outcome; and between them there is the cerebral track of the nervous current: of which stage then of the nervous process is the idea strictly the conscious correlate? The correct answer probably is that the entire process is necessary to the formation of the idea in the first instance, but that when its substrata have been definitely organised, a mental representation, faint or vivid, of either the first or the last stage, in connection with the cerebral intermediate process, may suffice; this mental representation consisting in an internal excitation of the proper perceptive or motor centre in the convolutions. A faint or nascent sensory perception may suffice in the one, it may be supposed; as a faint or nascent motor percept or intuition may in the other. And if we go on to reflect upon our ideas, we shall notice that with some the sensory element plainly predominates, so that we have the image vividly before our mental eye; with others, the motor intuition is predominant, so that the word by which we denote the idea engages consciousness; while with other ideas of a more abstract character the intermediate cerebral factor is chiefly in operation, and little attention is paid to image or name. In the latter case we allow thought to call up thought without bringing it back to its sensory basis or to its motor expression, although at the same time we feel it necessary to do both when we would positively satisfy ourselves that we have a clear, definite and genuine idea. It will be noticed also in this relation that we can intensify an idea either from the sensory or the motor pole of its cerebral process—either by presentation and vivid representation of the object, or by such active intuition of the word denoting it as we get by repeating it to ourselves internally in a sort of mental whisper or by uttering it aloud. In this way, when our attention is prone to wander from a train of reflection, we hold it to its task by emphatic internal repetition of the words or the motor expressions of the ideas concerned, or by vivid sensory representation of what we are thinking about. It would appear then that the idea is really the correlate of the entire excito-motor process in the convolutions, and that when either the sensory or motor element seems to be wanting, the reason is because it is understood; being in such a state of faint or nascent excitation that it scarcely rises into consciousness.

In using the physiological term 'excito-motor' to describe the process which takes place in the convolutions during ideation, and in referring it to the same category as the processes which take place in the lower nerve-centres, it behoves us to take heed that we do not overlook the complex nature of the nervous substrata which are subservient to it. Reflex function is merely a name, which neither conjures away difficulties magically nor furnishes an adequate explanation of them; indeed, so far as it pretends to be an explanation, it is distinctly an inadequate one, inasmuch as there is a great deal more in mental reflection than a simple reflection of energy through the supreme centres from an afferent on to an efferent nerve. The central nervous substrata contain in their structure, first, a vast original capacity, and, secondly, a vast acquired capacity: they embody, as it were, a certain *pre-established* harmony between their functions and the environment, which has been inherited, and a certain *established* harmony, which has been acquired by education and experience: they capitalise in a measure the acquisitions of the race, of ancestors, and of the individual. We cannot in the least comprehend how it happens, but we cannot doubt, that the individual inherits in his cerebral substrata not only parental but ancestral qualities of mind which are ready to come into function at different periods of life; so that the qualities of one ancestor may discover themselves more evidently at one period, and those of another ancestor more evidently at another period, of his life. Reverting to the comparison which was previously made between the nerve-cell and the germ-cell, and taking it to be probable that the former, like the latter, contains in latent form the potential qualities of many ancestors, male and female, we may understand that it should, like it, when placed under suitable conditions, display them in its development. We may understand also how it is that one part of the convolutions can so easily take on the functions of another part, if we suppose, as we may reasonably do, that the nerve-cells, like the germ-cells, are endowed with very similar if not identical properties, and are therefore equivalent before they begin to function and to undergo that differentiation which, if not determined by original differences of properties, is involved in development under different conditions. It has been already shown that they exist in the convolutions in such countless numbers that it is probable only a small proportion of them is ever utilised. However that may be, it is evident that when a stimulus excites the function of an ideational track for the first time, it does not merely excite a movement which passes along it without addition of energy, but awakens echoes that sound from we know not how far back in the past.

Having said thus much concerning the nature of ideas and the manner in which they are acquired, I proceed next to indicate the different ways in which observation shows that the energy of an idea may be discharged: having considered its formation, it now remains to consider it in actual energy.

(*a*) The reflex action or reaction of an ideational nerve-current is downwards upon the motor centres, and thus gives rise to what has been called *ideomotor* movement.*(5) The energy may be exerted either upon the involuntary or upon the voluntary muscles; in the latter case, taking place either with consciousness or without consciousness. The idea that the bowels will act may notably sometimes so affect their involuntary peristaltic movements as to produce evacuation of them; the idea that vomiting must take place, when a qualmish feeling exists, will certainly hasten vomiting; and there is a very remarkable instance in the *Philosophical Transactions* of a man who could for a time stop the motions of his heart by composing himself, and then either conceiving vividly or directly willing what was to happen.* (6) These are examples of the influence of idea upon the involuntary muscles, and they accord with what has been previously said of the subordination of the organic nerve-centres to the cerebro-spinal system. Some people even are able, through a vivid idea of shuddering, or of something creeping over their skin, to produce a *cutis anserina* or goose's skin: the immediate effect of the idea in this case, however, is probably to excite the appropriate sensation, which thereupon gives rise to the sequent phenomena.

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* "To prove that Ideas, as well as Sensations, are the cause of muscular actions, it is necessary to make choice of cases in which the idea is in no danger of being confounded with that state of mind called the Will. And hardly any case will answer this condition, except some of those which are held to be involuntary, for the Idea itself never can be very clearly distinguished from the Will."—J. MILL, *op. cit.* p. 265. He instances yawning on seeing some one yawn, the infectious power of convulsions, laughter, sobbing, the swallowing of saliva, if assured that you cannot. "It seems, therefore, to be established by a simple induction, that muscular actions follow ideas, as invariable antecedent and consequent, in other words, as cause and effect; that, whenever we have obtained a command over the ideas, we have also obtained a command over the motions; and that we cannot perform associate contractions of several muscles, till we have established, by repetition, the ready association of the ideas."—Ibid. p. 274.

† "The idea of a particular motion," says Müller, "determines a current of nervous action towards the necessary muscles, and gives rise to the motion independently of the will." Again, of expectation, he says—"It may be stated, as a general fact, that any state of the body which is conceived to be approaching, and which is expected with certain confidence and certainty of its occurrence, will be very prone to ensue as the mere result of that idea."

Examples of the action of idea upon our voluntary muscles are witnessed in every hour of our waking life. Very few, in fact, of the familiar acts of a day call the will into action: when not sensori-motor they are usually prompted by ideas. Most of the earlier actions of children are prompted by ideas and feelings which, excited by suggestions from without, immediately pass into movements. In the adult, it sometimes happens that without any intervention of the will, or even in direct defiance of the will, an idea discharges itself in movement or produces some other effect upon the body. The suddenly excited idea of the ludicrous, for example, causes involuntary laughter; the idea of an insult, a quick movement of retaliation; the idea of a beautiful woman, a glow of amatorial passion; the idea of a great impending danger, or of a sudden terrible affliction, serious or even fatal disturbance of the organic life; the idea of an object, an actual hallucination sometimes. In the phenomena of electro-biology or hypnotism, the mind of the patient is possessed with the ideas which the operator suggests, so that his body becomes an automatic machine, set in motion by them. Every one's experience will recall to him occasions on which an idea excited in his mind could not be dismissed therefrom by the will, and perhaps would not let him rest until he had realised it in action, even though such realisation appeared to his judgment inadvisable. But the point on which I would lay stress here is, that such ideomotor movements may take place, not only without any intervention of the will, but also without consciousness; they are automatically accomplished, like the actions of the sleep-walker, in obedience to an idea or a series of ideas of which there is no active consciousness.

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* "There is an instance told in the *Philosophical Transactions* of a man who could for a time stop the motions of his heart when he pleased; and Mr. D. has often told me he could so far increase the peristaltic motion of his bowels by voluntary efforts as to produce an evacuation by a stool at any time in half-an-hour."—*Zoonomia*, vol. i. p. 39.

It may seem paradoxical to assert, not merely that ideas may exist in the mind without any consciousness of them—which every one admits that in their dormant, latent, or statical condition they may—but that an idea, or a train of associated ideas, may be quickened into action, and actuate movements, without itself being attended to. But those who reflect upon their actions will acknowledge that it is unquestionably so: a great part of the chain of our waking thoughts, and of the series of our daily actions, never is attended to; at first consciously acquired, they have now become automatic, the effect being that which first arouses consciousness, if it be aroused at all. Persons who have a habit of talking to themselves are generally unaware that they are talking, and yet they are performing both associated ideas and associated movements; and one who has a lively interest in some performance which he is watching intently, can hardly forbear making ludicrous movements of imitation. The phenomena of table-turning, spirit-writing, divining with the magnetic rod, and the like, when they are not impostures, illustrate in like manner the unconscious action of idea upon movement, as do also the sudden cures of supposed paralysis which have sometimes been effected by an impressive command to rise and walk from one who claims a miraculous power of healing, or by the application of some instrument alleged and believed to have marvellous healing virtues. In such cases the idea of the movement, the belief that it will take place, is truly the movement in the innermost; it is the current of nervous action which, when transmitted along the proper nerves, will become the external movement. And it is not without interest to note how in some of these instances the vivid idea of a movement may produce a more powerful effect than a deliberate exertion of will could do; for the idea represents undivided energy operating in a definite channel, no other ideas or feelings intervening to produce doubt or irresolution, while there is not, from want of a proper training of mind, the power of effective co-ordination of its various energies into a complete and definite act of will. Indeed, the miraculous cures of paralysis which are from time to time recorded, take place commonly in hysterical persons whose malady is a paralysis of will rather than a paralysis of muscle.

It is surprising how uncomfortable a person may be made by the obscure notion of something which he ought to have said or done on some occasion, but did not say or do, and which he cannot for the life of him remember. There is a dim feeling of some impulse unsatisfied, an effort, as it were, of the lost idea to get into consciousness; the activity thereof not being sufficient to excite distinct consciousness, but sufficient to react upon the unconscious mental life, and to produce a feeling of discomfort or vague unrest, which is relieved directly the idea bursts into consciousness. Certainly the tone of mind at different times is much affected by obscure subactive ideational currents which do not reach the level of distinct consciousness, not otherwise than as there are undulations constantly striking upon the senses of sight and hearing which are too feeble to excite definite sensations of sight or sound. Then, again, when an active idea has once taken fast hold of consciousness, how hard a matter it is to dismiss it! Some weak-minded persons cannot do so until they have expended its force in suitable action: let a hysterical woman get a vivid idea of some action that she must do or cannot do, the idea becomes a fate which she must sooner or later obey, not otherwise than as a person who is in a state of so-called mesmerism or hypnotism is dominated by the idea which the operator suggests. Let a quick-tempered man conceive a great insult suddenly done to him, in a moment, without any intervention of the will, the idea reacts upon the muscles of his body, and produces more or less general tension of them. Let a man engaged in a fight or a race get the idea that he will be beaten, his muscular energy is weakened, and he is already half vanquished: let another have the idea that he will win, his muscular energy and skill are augmented, and he is already half victor.

(*b*) The ideational nerve-current may operate downwards not only upon the motor nuclei, but also upon the sensory ganglia. As the idea is excited into activity by the impression on the senses, so it may in turn react backwards upon the sensory centres, giving rise even under certain circumstances to illusions and hallucinations. "I am confident," John Hunter said, "that I can fix my attention to any part until I have a sensation in that part." The idea of a nauseous taste or of a putrid stench may excite the sensation to such a degree as to produce vomiting; and the sight of a person about to run a sharp instrument over glass will set the teeth on edge. The images of dreams, as Spinoza remarked, are sometimes actually visible for a short time after the eyes are open on awaking. "On awaking one morning out of a distressing dream, just as day was breaking, the images I had had present to me in my dream floated before my eyes as distinctly as if they had been actual objects. One form in particular, that of a leprous negro, whom I had never seen in my life, presented itself to me with singular distinctness, but faded and in a great measure disappeared when, to turn my thoughts to something else, I fixed my eyes on a book; as soon, however, as I allowed my eyes to wander from the page the vision of the blackamoor presented itself with the same vividness as before. By and bye it began to fade, and anon it disappeared entirely." * "The celebrated Baron von Swieten," says Dr. Darwin, who illustrates this kind of ideational action by many instances, "was present when the putrid carcase of a dead dog exploded with prodigious stench; and, some years afterwards, accidentally riding along the same road, he was thrown into the same sickness and vomiting by the idea of the stench as he had before experienced from the perception of it."

The action of idea upon sensory ganglia is a constant

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* Letter to P. Balling. See WILLIS's *Translation of Spinoza*, p. 289. I have on several occasions experienced this persistence of dream-images on awaking in the night out of a dream, notably after tours in North Wales and Switzerland, in which I had made mountain ascents. Pursued in dreams by vivid images of mountain peaks and precipices, and steep and difficult paths, I could not, for a little while after awaking, realise that I was safe in bed, for I continued to see the images of the dream, and was obliged to put my hands out and grasp each side of the bed to convince myself.

part of our mental life; for the co-operation of sensory activity is, as I have already pointed out, necessary to the completeness of the idea—to clear conception and representation. In order to form a distinct and definite conception of what is not present to sense, we are compelled to form some sort of image of it in the mind; the sense of sight, which is anatomically in most extensive connection with the cerebral ganglia, affording us the greatest assistance in this regard. Men differ much in the power which they have of thus rendering an idea sensible. Goethe could call up the image of an object at will, and make it undergo various transformations before his eyes in accordance with the changes which he conceived in it; and Shelley appears to have been, on one occasion at least, the victim of positive hallucinations generated by his ideas. But the most remarkable instance of a habit of seeing his own ideas as actual images was afforded by the engraver, William Blake—"You have only to work up imagination to the state of vision, and the thing is done," was his own account of the genesis of his visions.* To render definite the creations of the imagination, and to give fit expression to them, they must be accompanied by some sensorial representation. The great writers whose vivid descriptions of character, scenery, or events hold our attention and stir our feelings, have this power in high degree; they create for themselves a world of sense by the influence of idea, and then strive to present vividly to us what they have thus represented to their own minds.

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* Dickens used to allege that he heard his characters actually speak to him. "Mes personnages imaginaires m'écrit le plus exact et le plus lucide des romanciers modernes, *m'affectent*, me poursuivent, ou plutot c'est moi qui suis en eux. Quand j'écrivais l'empoisonnement d'Emma Bonary, j'avais si bien le goût d'arsenic *dans la bouche*, j'étais si bien empoisonné moi-même, que je me suis donné deux indigestions coup sur coup, deux indigestions très réelles, car j'ai vomi tout mon dîner."—TAINE, *De l'Intelligence*, vol. i., p. 94. The more striking, as arsenic has a scarce appreciable taste. "Dr. Ferrier mentions of himself that, when at the age of fourteen, if he had been viewing any interesting object in the course of the day, as a romantic ruin, a fine seat, or a review of troops, as soon as evening came the whole scene was brought before him with a brilliancy equal to what it possessed in daylight, and remained visible for some minutes."—ABERCROMBIE, *On the Intellectual Powers*. Sir I. Newton could recall an ocular spectrum of the sun when he went into the dark and directed his mind intensely, "as when a man looks earnestly to see a thing which is difficult to be seen." From these

Natural endowments being equal, those writers who have the greatest number of residua stored up in consequence of much and varied experience, are best qualified to call up vivid images, and best qualified to call up such as are truly representative of nature; whilst those who are wanting in experience, or who have not sufficiently cul-

recollected images of objects of sense, which the reason duly distinguishes from the realities around, we meet with examples marking a gradual transition to those spectral images or illusions which cannot be distinguished from realities, which, in fact, compel belief, and excite emotions and actions in accordance with their character. Abercrombie mentions the case of a gentleman who was all his life affected by the appearance of spectral figures. Meeting a friend in the street, he could not satisfy himself sometimes whether he really saw the individual or a spectral figure, unless by touching the figure or listening to the sound of his footsteps. He had also the power of calling up spectral figures at will, by directing his attention steadily to the conceptions of his own mind, whether figures or scenes he had seen, or a composition of the imagination. "But though he has the power of producing the illusion, he has no power of banishing it; and when he has called up any particular spectral figure or scene, he can never say how long it may continue to haunt him." An intense mental impression may produce such illusion involuntarily. A step farther, and there is neither the power of calling up an illusion at will—for it rises in spite of the will—nor of distinguishing it from realities, nor of dismissing it at will. It is excited by some morbid cause, confounds itself with realities, compels belief, and dominates the conduct. This is the case with those insane persons who hear voices continually speaking to or of them, replying to their unuttered thoughts, suggesting blasphemous or obscene ideas, and reviling or threatening them.

tivated observation, are sure to become visionary, vague, and unreal. Even in matters of scientific research, the scientific imagination by which hypotheses are successively framed until a fit one is obtained, its verification completed, and a discovery thus made, is based upon a previous careful training of the senses in scientific observation, and works by means of sensory representations. Natural endowments not being equal, however, we then perceive the wide difference which there is between one who has adequate ideation and one who has not. The latter, in describing character, scenery, or events, will give a tedious picture characterised by minute industry and overwrought detail, in which there is no due subordination of parts, no organic unity of idea—in which truly soul is wanting—and from which, therefore, no one can carry away a true idea of the whole: unpregnant of his subject, he has gone about to give a photographic copy or a minute delineation of what cannot be photographed; he has laboured to realize the appearance until at last only something unreal remains.* The former, on the other hand, produces, by virtue of the plastic power of idea, a picture in which the unessential is suppressed, the essential extracted and moulded into an organic unity, in which due subordination and co-ordination of parts prevail, and from which, therefore, a true idea of the whole may be educed; truly comprehending or grasping his subject, he has in fact idealised the sensory perceptions, producing the illusion of a higher reality, and so displayed a real development of nature.

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* "For facts," Lord Shaftesbury observes in his *Characteristics*, "unably related, though with the greatest sincerity and good faith, may prove the worst sort of deceit: and mere *lies*, judiciously composed, can teach us the truth of things beyond any manner. But to amuse ourselves with such authors as neither know how to *lye*, nor *tell truth*, discovers a taste which methinks no one should be apt to envy. The greatest critic says of the greatest of poets, when he extols him the highest, that above all others he understood *how to lye*: Δεδιδάσχε δὲ μάλιστα Ὅμηρος καὶ τοὺς ἄλλους πσευδῆ λεγεῖν ὥς δεῖ."

This sort of difference between men is not less evident in scientific working. One man records, with a praiseworthy but tedious industry, the unconnected impressions made upon his senses, and never gets further than that: fondly thinking that he sees with his eye, and not through it, he is very much like one who should, were he set to describe the sun for the first time, delineate with great care and exactness its appearance to the eye, and rest content for the future with this sensory representation of it. The other and truer man of science succeeds in combining, by means of the organising power of idea, the scattered impressions made upon the senses, is able by comparison to complement or correct the impression made on a particular sense, and to form to himself a true image of the sun, not as a mere disc of fire, but as an immense central body moving through space with its attendant planetary system. Only those who are destitute of idea would dream of rejecting entirely the aid of idea in scientific inquiries.

These observations will not be a useless digression if they serve to teach how essential to the completeness of conception is the functional action of the sensory ganglia; how much our intellectual development depends, not only upon the cultivation of careful habits of observation, but also upon the co-operation of the sensory centres in the subsequent intellectual action. The excitation and cultivation of the sensorial centres are necessary antecedents, in the order of mental development, to the activity of the ideational centres; and the ideational centre in turn performs its complete function in the formation of a distinct conception by reacting downwards upon the sensory centres. This secondary intervention of the sensory ganglia is not peculiar to man, being, perhaps, more evidently displayed in some of the lower animals in which the ideas are so much fewer and so much less complex than in man. When the dog scents the rabbit, and begins to scratch furiously at the burrow, it is plain that the sense of smell has excited either directly the visual image of the rabbit, or rather, as the dreaming of the dog would seem to indicate, the idea of the rabbit, which idea thereupon calls up the appropriate visual image. It is worthy of remark in this relation, how singularly effective in man the sense of smell is in recalling vividly the ideas and images of forgotten scenes and places: there are certain smells which never fail to bring back to me instantly and vividly scenes of my boyhood, though I was not in the least thinking of them at the time.

The reaction of ideas upon the senses is again very notable in dreams: for my part, when dreaming, I sometimes see pages of printed matter, which I read with a conscious effort and, as it were, a straining of the eyes, and understand; nay, more, I may awake, recognise it to be a dream, close my eyes, go instantly to sleep again, and resume the reading, continuing it by an effort, and conscious that the whole thing will vanish if my attention be withdrawn. At one time or another, most persons must have been awakened suddenly by the distinctly heard voice of a dream-image. In insanity, when the nerve-centres are disordered and their relations disturbed, actual hallucinations of a sense, such as cannot be corrected by the evidence of unaffected senses, or by reflection, are sometimes due to the influence of morbid ideas. This disordered action is, after all, only an exaggeration of a process which is natural in our mental life. The idea cannot receive its stimulus directly from the external world, nor can it react directly upon the external world: both in its origin and in its expression are the senses concerned.

The idea of a sensation, which we have seen to be sometimes so vivid as to become an actual hallucination, is no doubt an internal current or movement which is an imperfect reproduction of the movement caused by the external impression; it will naturally therefore increase the susceptibility to such impression, forasmuch as the movement in the nervous centre occasioned thereby will be more easily and completely excited in consequence of being already in partial action; in other words, susceptibility will be increased by attention.* The madman who has the delusion that poison is secretly put into his food, or that persons in the streets say offensive things to him or of him, readily tastes the poison which is not there, or misinterprets innocent words to fit his thoughts; the lover "sees Helen's beauty in a brow of Egypt;" and the poet finds his moods of feeling in the aspects of nature. The external impression easily produces the feeling which each is prepared to feel. For the same reason expectant idea is a potent cause of hallucination. The man who sees a ghost is he who expects to see one. In making his experiments on hypnotism, the phenomena of which are of the same nature as those of mesmerism, Braid found that if susceptible persons believed that something was being done, although they did not see it, by which they were to be affected, they would become affected, while, on the contrary, the most expert hypnotist might exert all his endeavours in vain if the person did not expect it. He relates the case of a lady who, when told to look intently at a horse-shoe magnet in a dark closet, saw nothing; but when told to look again and she would see sparks of fire issuing from it, presently saw fire burst forth from it, which she continued to see when the magnet had been secretly removed. In like manner, at the so-called spiritual *séances*, the idea of an event being about to happen will produce in some persons a conviction that they actually see or feel it happen. A person of a certain sort of nervous temperament, sitting in the dark for some time in complete silence, having the feeling of some mysterious agency at work, and eagerly expectant, gets into such a state of mind that he is ready to perceive what he is confidently assured will occur, and perceives it accordingly, when what really occurred was perhaps something quite different. The rule of sound observation is that the mind should be free from a preconceived idea; the rule of those who call spirits from the vasty deep is that the mind should be possessed by the preconceived idea. It has been the same with miracle-mongers in all ages. The man who sees a miracle, like him who sees a ghost, is the man who expects to see one; wherefore the testimony as to miracles when religious emotional excitement prevails is of no value. As in a burning substance the heat given off by the portion that is combining with oxygen raises the adjacent part to a temperature at which it also will combine with oxygen and burn, so a high temperature of emotion in one person raises the temperature of emotion in his neighbour, and the epidemic of excitement and credulity spreads like wild-fire. It has always been the perverse custom of miracles to happen in the presence of those who were so full of faith that they did not require their occurrence in order to testify of them, and to fail to happen in the presence of those who were of so little faith as to doubt.

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* This has been proved experimentally. Perception, like every other mental process, takes time. This time, which has been measured, and which may differ in different persons, or in the same person at different times, is *less* if the nature of the impression to be made is known beforehand, *less still* if the instant of its appearance be foreseen.

It is a disputed question whether the idea or emotion, when it acts upon the sensory centres so as to produce a hallucination, transmits the current of nervous action along the sensory nerves to the organs of sense. Müller believed that a current passed in this way from the centre to the periphery, just as happens when the ideational current affects nutrition or movement. Certainly it has been proved by the experiment of uniting the distal portion of a divided sensory nerve with the proximal portion of a divided motor nerve, that a current may traverse a sensory nerve in a downward or efferent direction. On the other hand, it is certain that the hallucination would be generated if the sensory ganglia only were affected, and that the mind will always in such case refer the sensation to the peripheral end of the nerves. A person may have a visual hallucination when the retina and the optic nerve are so wasted as to be incapable of function, and an auditory hallucination when the auditory nerve is destroyed; and one who has had his leg or arm amputated feels sensations, as if he still possessed the lost limb, for some time after its removal. The transmission of the current to the periphery, whether it takes place or not, is clearly not essential. Some writers are in the habit of speaking of the sensation as not real but delusive, when it is of subjective origin. But the sensation is real, however it originate: the man who believes he sees a ghost has a real sensation of it, although he does not really see it, there being no object outside his eye to make that impression upon it which we mean by seeing. Like the dagger which Macbeth saw, it is before his mind's eye, but not before his bodily eye.

(*c*) A third important, though little recognised, way in which idea may operate, is upon the functions of nutrition and secretion. Whether the idea act, as is probable, directly upon the organic elements of the part through its nerves, or indirectly by an effect upon the vaso-motor system, or in both ways, it is certain that the energy of idea may increase or lessen a secretion, and may modify nutrition. The idea of food will cause a flow of saliva; a sympathetic idea, a flow of tears; the idea of suckling, a secretion of milk; the idea of itching in a particular spot will give rise to an itching there; and the idea that a structural defect will certainly be removed by a particular manipulation does sometimes so affect the organic action of the part as to produce a cure. The most successful physician is ever one who inspires his patient with the greatest confidence in the virtue of his remedies; and he is most likely to be attacked by epidemic diseases who most fears them. Bacon rightly, therefore, would have us inquire into the best means to "fortify and exalt the imagination." "And here," he says, "comes in crookedly and dangerously a palliation and defence of a great part of ceremonial magic. For it may be speciously pretended that ceremonies, characters, charms, gesticulations, amulets, and the like, do not derive their power from any tacit or sacramental contract with evil spirits, but serve only to strengthen and exalt the imagination of him who uses them." *

It is well known that a bread pill will sometimes purge violently one who, believing that he has taken a strong purgative, confidently expects the purgative effect, and a perfectly innocent draught may produce sleep, when it is believed to contain a narcotic. On one occasion I was consulted about an old lady who for years had been in the habit of taking two purgative pills, two or three times a week or oftener, and a dose of chloral every night. Her husband, who thought that she must be doing injury to her health by this practice, substituted bread pills for those which she bought, and greatly lessened the dose of chloral, without saying anything to her; the usual effect being produced in both cases. But it was always necessary that there should be a taste of chloral, however little the quantity of the drug, for the effect to be produced. The idea of a person that he will go to sleep, certainly promotes the occurrence of sleep; the idea that he will not,

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* De Augmentis Scientiarum, B. iv.

on the other hand, as certainly tends to keep him awake; and the idea that he must awake at a certain hour usually causes him to awake at that hour, or perhaps more often before it.*

The so-called *stigmata* which the ecstatic mystics professed to show on their hands, feet, side, or forehead, in imitation of the sufferings which Christ underwent from the nails, spear and crown of thorns, were effects of the action of idea upon nutrition, if they were not fraudulently produced. But it is impossible for those who are not eager to seize opportunities of practising faith, to avoid the suspicion that they who thus professed to bear in their bodies the marks of the Lord Jesus bore ulcerations artificially produced, for the marks most often occurred in women of highly nervous temperament, whom experience proves to be not unapt to simulate strange bodily affections. It is to be regretted that the examination in such cases, when they occur now, is seldom made with such strictness as to exclude fraud: if the hands are the seat of bleeding, it is evidently not enough to put them in strong gloves and to take every precaution that these cannot be taken off, if they are penetrable by a needle. In a case of alleged spontaneous bleeding from a part of the surface of the body which occurred at one of the London Hospitals, the imposture was detected by placing secretly in the covering which was fastened over the bleeding surface a piece of tinfoil, which was found on examination afterwards to have many perforations by a pin or needle. It should be borne in mind, when attributing such events to fraud, that it may not be deliberate deception in all cases. Deception is not a definite, constant mental state, which either is or is not, and which therefore when it is not, may be eliminated entirely from consideration. There are various degrees of deception ranging from the most wilful deception to the most innocent unconscious self-deception; and assuredly the greatest impostor is he who imposes upon himself as well as upon others. We ought in this relation to take account of those peculiar states of abnormal consciousness which occur in dreaming, hypnotism, epilepsy, catalepsy, even ecstacy, and the like morbid states, when it will appear not impossible that a person might, in a so-called ecstatic trance or vision, fabricate a stigma, and yet be unaware, when he returned to normal consciousness, of what he had done when he was, as it were, alienated from his proper self. For it is certain that those who fall into these anomalous states may, when they come to themselves, be quite ignorant of what they did while in the state of abnormal consciousness. I doubt not that some of those who suffered from what I take leave to call theolepsy were of this class.

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* This is a curious fact, as it would appear to indicate that there is an appreciation of the lapse of time during sleep. We observe something of the same kind in the day, for a man who has not heard a clock strike, or looked at a watch, has a tolerably accurate notion what the hour is, especially if he has been going on in his usual routine.

(*d*) There is yet another path which the energy of an idea may take. As, in the function of the spinal cord, the current of nervous action which did not pass directly outwards in the reaction travelled upwards to the sensorium commune and excited sensation; and as in sensori-motor action the current of nervous force which did not pass outwards in the reaction travelled up to the cortical cells, and gave rise to idea; so in ideational action the current which does not pass, or which may be over and above what does pass, immediately outwards in the reaction, abides in operation in the cortical centres, and passes therein from plexus to plexus of the complicated mechanism. There is no superimposed collection of nerve centres of a higher kind to which it might now ascend, and wherein it might excite a higher kind of mental activity; there is, instead, an infinite multitude of nerve-cells in the cortical layers, having most numerous, varied, and intricate connections, whereby excitation may be communicated from one to another. This communication is what does take place when one idea calls up another by some association, itself partly or wholly disappearing in the act. It is probable that one idea can only call another into activity through its own partial or entire disappearance from consciousness, as one wave disappears in the production of another; but it is, perhaps, doubtful whether this, which is Müller's simile, expresses the condition of things so well as that of Hobbes, who looked upon one idea as obscured by the more active one, "in such manner as the light of the sun obscureth the light of the stars; which stars do no less exercise their virtue, by which they are visible, in the day than in the night."[*] (7) There is as would appear, not only a transference of energy from cell to cell within the hemispherical ganglia but a transformation thereof in the process; and the energy of the particular current, or the idea for the moment active, is attended with consciousness. We are now come, then, to another sphere of mental function, namely, function within consciousness, or mental reflection.

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[*] Dr. Brown (*Physiology of the Mind*, p. 223) held, however, that the slightest attention to the successive states of mind would show, "that a conception, after giving rise to some new conception, does not always cease to be itself a part of our continued consciousness." He thought that it often remained so as to co-exist with the conception which itself had induced, and might afterwards suggest other conceptions, or other feelings, with which it might then coexist in a still more complex group. "We compare, we choose, in our internal plans, because different objects are together present to our conceptions." Sir W. Hamilton limited to six the number of objects which might exist in consciousness at the same time; and Mr. J. S. Mill, in his *Examination of Sir W. Hamilton's Philosophy*, allows a "*great multitude of states, more or less conscious, which often co-exist in the mind!*" On this question Sir H. Holland has some excellent remarks in his "Chapters on Mental Physiology." German philosophers differ also with regard to the answer, some upholding, with Müller, a single conscious state, others a co-existence of conscious states. It would appear that ideas are in this regard like movements: several of them may be in simultaneous action, though not simultaneously present to consciousness. For my part, it seems to me clear that I can see more than one object at a time, but that

It behoves us here to settle clearly in our minds the relation of consciousness to ideational function, or at any rate to be on our guard against considering consciousness as co-extensive with such function. When the whole energy of an idea passes immediately outwards in ideo-motor action, then there is scarce any, or there may be no, consciousness of it; in order that there may be consciousness of the idea, it is necessary not only that its excitation reach a certain intensity, but that the whole force of it do not pass immediately outwards in the reaction. When an idea disappears from consciousness, it does not necessarily disappear entirely; it may remain in latent action below the horizon of consciousness, the currents of molecular motion subsiding gradually before it ceases entirely. Moreover, it may produce an effect upon movement or upon other ideas when thus active below the horizon of consciousness; for when we find the same effect produced unconsciously which we know it to have produced when we were conscious, we justly infer the activity of the same cause; the more confidently so because we may sometimes, when our consciousness is unexpectedly aroused to its operation, or withdrawn from something else which was occupying

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when I endeavour to think of two things at the same time, my consciousness passes rapidly from one to the other. When I do appear to be conscious of two or more ideas at the same time, it is that the ideas have coalesced into one complex idea, or so nearly so that while I have active consciousness of the one, I am capable, at the same time, of a subactive consciousness of the other.

its field, catch it in the act. The persistence for a time of a certain degree of intensity of energy in the ideational circuit would certainly appear to be the condition of consciousness. Accordingly when the process of reflection is going on quietly and rapidly, through the regular association of ideas, there is no consciousness of the steps; in the train of thought one idea calls another into activity without being itself attended to, so that the result may appear sudden and accidental, and it may be very difficult, or quite impossible, to retrace the steps or take up the successive links by which it was evolved. In the course of a day how many thoughts or ideas do thus suddenly start into consciousness, or, as we may say, suddenly strike us! The excitation of one ideational current would seem to be communicated immediately to another, and the energy thus to run through a series by a continuous transformation, with no persistence at any of the intermediate stages.

A conception of the way in which a group or series of movements is observably associated, and the faculty of them is firmly organized in the nervous centres, so that they are thenceforth automatically performed, will be found most serviceable in the interpretation of the phenomena of ideational activity. In the one case as in the other, there must be an organization in relation to the environment by means of education, a young child's ideas and movements being alike vague, vivid, transient, and incoherent. Like muscular motions, ideas are associated in groups or series, getting closer and closer together by repetitions, until they so coalesce as, like sensations which appear simple to consciousness but are really compound, to leave no trace of their separate existence in consciousness; like movements, they become easier with repetition; like them, they are excited into action by appropriate stimuli; like them, when once associated, they are not easily separated, and may become indissoluble; like them, they may be accomplished without consciousness; like them, they demand an appreciable time for their accomplishment; and, like them, they are fatigued by prolonged exercise. The question of the time necessary for the performance of an idea is really a most important one, which has not hitherto received sufficient attention. The time is appreciable, and is sometimes not less than that required for the performance of a muscular motion; for, as Dr. Darwin observed, a musician can press the keys of a harpsichord with his fingers in the order of a tune which he has been accustomed to play, in as little a time as he can run over those notes in his mind. Nay, an idea may even require more time than a movement: how many times in a day do we cover our eyes with our eyelids without ever perceiving that we are in the dark? In this case, as Dr. Darwin has also observed, the muscular motion of the eyelid is performed quicker than the idea of light can be changed for that of darkness, the twinkling of an eye being quicker than thought. (7)

The interference of consciousness is often an actual hindrance to the association of ideas, as it notably is to the performance of movements that have attained the complete ease of an automatic execution. It happens that we try hard to recall something to mind, and are unable by the utmost effort of volition and the strongest direction of consciousness to do so: we thereupon relinquish the attempt, and direct our attention to something else: and, after a while, the result for which we in vain strove flashes into consciousness: the automatic action of the brain has worked it out. That is exactly what we might expect to happen; for if consciousness implies a persistence of the tension of a nerve-cell's energy, then in proportion to the degree of persistent tension must be the retardation of, or hindrance to, the process of association of ideas which is effected by a transference of energy from one to another of the catenated cells. For the same reason strong emotion is unfavourable to reflection: certain cells or cell-territories continue in a state of molecular commotion, and only excite by association sympathetic ideas, that is, ideas related to the strong feeling which is the exponent of their activity; the free course of a varied association being prevented. Anger is a short madness, because, like the fixed delusion of monomania, it marks the preponderating activity of a certain area of cells, and the exclusion of full and unimpeded transmission or reflection of energy. How can there be true deliberation when one end of the balance is falsely weighted?

An active consciousness is always detrimental to the best and most successful thought; the thinker who is actively attentive to the succession of his ideas is thinking to little purpose; what the successful thinker observes is that he is conscious of the words which he is uttering or writing, while the thought, unconsciously elaborated by the functional action of the brain, flows from unpenetrated depths into consciousness. In reverie the train of meditation goes on with little or no consciousness of its successive links, and may go on until attention is aroused by some startling thought which the person cannot at first imagine how he came to have. It is only when he can deliberately trace backwards the succession of ideas that he discovers how he conceived it. *Reflection* is then, in reality, the reflex action of the cells in their relations to the cerebral ganglia; it is the reaction of one cell to a stimulus from a neighbouring cell, and the sequent transference of its energy to another cell—the reflection of it. *Attention* is the arrest of the transformation of energy for a moment—the maintenance of a particular *tension*. When the tension is maintained at a certain elevation, without being excessive, there is a state favourable to a radiation of energy in all directions, so that all the related ideas are aroused; and it is a condition of the best mental development to establish and keep open a great many channels of radiation, by means of a varied cultivation and exercise of mind. There can be little doubt that alcohol and opium sometimes aid imagination by stimulating torpid molecules, and by so opening up unused or obstructed paths of association. Bear in mind what was said of the varying value of an idea and of the manner of its gradual organization in the nervous centres, and the applicability of the term *deliberation* to a process of thought, as a weighing or balancing of one reason against another, will be evident. Or if we prefer the term *ratiocination*, we may say, with Hobbes, that by it is meant *computation*. "Now to compute is either to collect the sum of many things that are added together, or to know what remains when one thing is taken from another. *Ratiocination*, therefore, is the same with *addition* and *subtraction*." Subtract the energy of an opposing desire from a more powerful one, and the energy left represents the resultant force of impulse after deliberation; add the energy of a like desire to another, and the sum represents the force of the resolution. After severe reflection or deliberation the decision or resolution may be held to signify that the individual has resolved, to the best of his ability, the complex equation set him; that he has guided the fundamental desire through the complex processes of deliberation, adding here and subtracting there, until it has come out in the best volition of which, with his mental plexuses such as they are by constitution and education, he is capable.

Though reflection is a process of mental activity which takes place within consciousness, yet consciousness itself, when fairly examined, will show how limited is the power of mind over the train of its ideas. The foundation of an idea is an organic process that takes place by imperceptible degrees beyond the range of consciousness; the idea, when formed, may be said to exist in a latent, dormant or statical state; and it may even be made active, and its energy duly expended, without consciousness. In like manner the catenation of a group or series of ideas is an organic process of which consciousness has no knowledge, and over which volition has no control; once the train is firmly linked together by this organized coherence, the excitation of one must needs bring on the excitation of the others, one after another, as it traverses its appointed orbit, rising above the mental horizon into consciousness, and in due order again sinking below it. The power of the mind over the succession of its states is plainly at best but a limited faculty; herein corresponding with that limited control which the individual has over the phenomena of his bodily life, where conscious and unconscious, voluntary and involuntary, acts are so intimately intermixed. To make states of consciousness synonymous with states of mind, as some have heedlessly done, is scarcely less unwarrantable than it would be to assert all bodily acts to be conscious acts.

It is not part of my design to attempt to give a full exposition of the different mental processes and to go into a complete analysis of their nature, and I pass quickly therefore over many subjects concerning which it would be interesting to speculate. One of these is the nature and influence of attention. Whatever its nature, it is plainly the essential condition of the formation and development of mind. Children learn well or ill, as monkeys do, according to the capacity of attention which they display, and in after life fruitful reflection upon a subject is possible only where there is the power of concentrating the attention.* It is plain that those who attend carelessly to an object or event with which they are concerned will receive only feeble and inadequate impressions from it, and that the effects will be imperfectly registered in the appropriate nervous centres; wherefore it is improbable they should rightly understand it, and impossible, if they collect other materials of thought in the same heedless way, that they should exhibit exact reasoning and exercise sound judgment. Many persons assuredly give only a glancing attention to other subjects than those which they have been drilled to attend to by the education which they have received and by the special pursuits and habits of their lives; and if we reflect upon the formation and action of the mechanism of thought—how it is developed in adjustment to impressions in order to react in definite ways, we shall easily perceive how it is that they become automatic machines for giving out unsound conclusions when they pass judgment upon matters that lie at all outside their accustomed grooves of mental function. They are faithfully stamped, like bank-notes, with the same marks, and their thoughts and feelings will alone pass current among those of their sect, party or country who are

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* "A man who trains monkeys to act used to purchase common kinds from the Zoological Society, at the price of five pounds for

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each; but he offered to give double the price if he might keep three or four of them for a few days, in order to select one. When asked how he could possibly so soon learn whether a particular monkey would turn out a good actor, he answered that it all depended on their power of attention. If when he was talking or explaining anything to a monkey, its attention was easily distracted, as by a fly on the wall or other trifling object, the case was hopeless. If he tried by punishment to make an inattentive monkey act, it turned sulky. On the other hand, a monkey which carefully attended to him could always be trained."—DARWIN's *Descent of Man*, vol i., p. 45. Very notable in imbecile or idiotic children is the lack of power of attention; when a new object is presented to them they throw it aside or turn away from it directly, without getting from it the informing impressions which it should produce; their defective nervous structure is deficient in or destitute of its fundamental property of adaptation to the environing medium.

similarly stamped. The revelations of modern science are foolishness to those who have been trained to accept supernatural revelations, and who have remained content with that training, and when the springs of their thought are touched they will give out the same predictable results with mechanical uniformity. It is the same with all men who have undergone a one-sided development: when subjected to impressions to which their minds have not been adjusted, these produce no intelligent effect —are as sound to the deaf, as light to the blind. One need not converse long with ordinary persons, if their education, position and pursuits be known, without feeling pretty confident what opinions they will express on any social, political, or religious subject which may be broached in their presence. To travel daily to a large city by rail, and to listen to the usual conversation of the commercial men who are on their way to business, becomes as wearisome as to watch the operations of a thrashing machine, for the results are almost as automatic in the one case as in the other.

It is an obvious distinction to make between involuntary and voluntary attention; the interest of the object or subject forcibly soliciting it in the former case, while it is said to be directed by an effort of will in the latter case. When a present object or event of interest engages the attention earnestly, it is easy to understand that the nervous centres which minister to the perception may be in active operation and that an intense consciousness may be thereby produced. When the object or event is no longer present to sense, but the idea of it engages the attention, it is reasonable to suppose that the same nervous centres are in operation and in the same way; not, however, with the same intensity usually, whence it happens that the attention is more apt to wander, in other words, the energy is more apt to radiate along other plexuses. The idea may be of such a nature as to hold the attention fast without any auxiliary effort of will, or even in spite of efforts of will to withdraw attention from it. Now two observations in regard to attention have been made which are of some interest; the first is that it has the physical effect of increasing the sensibility of the nerve to weak impressions, persons obviously hearing, feeling, smelling more acutely when their attention is on the strain; and the second, which is perhaps a consequence of the first, is that the appreciable time which elapses between the action of a stimulus upon a sense and its perception is distinctly shorter when the impression is attentively expected than when it is unexpected. This is in accordance with the previous inference that an active idea is accompanied by a molecular change in the nervous elements, which is propagated either along the sensory nerve to its periphery, or, if not so far, at any rate to the sensory ganglion, the sensibility of which is thereby increased. The result of this propagation of molecular action to the ganglion is that the different muscles in connection with the affected sense are put into a certain tension by reflex action, and thereby increase the feeling of attention, in accordance with the law that associated feelings strengthen one another. Let it be noted, moreover, that the increase of sensibility by attention is in entire harmony with what I have previously said concerning the habitual operation of ideas upon the sensory centres, and their occasional operation in producing illusions and hallucinations.

When we give intense attention to a perception, or to the performance of an act or of an idea, we are distinctly conscious of a feeling of tension; a feeling which, when we search back through our experiences, we find to resemble the feelings of muscular tension more closely than anything else, and refer accordingly to the category of motor innervation. When we look intently at an object, our ocular muscles are put into a state of tension;

when we listen intently, our auditory muscles; when we sniff intently a scarce perceptible odour, our nasal muscles; when we touch intently some object, so as to have a very nice feeling of it, the muscles of the part which we are using: the result of the co-operating stimuli of the muscular sense in all these instances being to increase the activity of the original sensation. In fact, as the perception of the object consists of the affection of sense *plus* the correspondent muscular feelings, it is obvious that a greater excitation of the latter will compensate for a feebler impression upon the former in bringing the object clearly into the field of consciousness. It is well known that impressions escape consciousness from inattention; and it is well known also that a person may sometimes, by deliberately practising attention, perceive impressions of which he would otherwise have been unconscious, just as he can by attention and practice gain a voluntary power over muscles which are commonly beyond the control of will. For example, as he may succeed in voluntarily moving the muscles of the ear and even of the iris, so he may succeed in distinguishing some of the tones which unite to constitute the quality of a musical note which appears to be simple. In this case there is obviously a tension of the auditory muscles, the extremely delicate variations of which, answering to the differences of vibrations of sounds, reveal themselves in consciousness as discriminating perception: the process corresponding exactly with that which takes place in the ocular muscles when a person learns to measure with his eye nice differences of distance.

But it may be asked, How can motor innervation be a factor in the operation of will in a mental act when, so far as appears, no muscular act is concerned? The reply which there seems good warrant to make is that motor innervation invariably accompanies the simplest effort of what seems to be pure will. When we think of an object which is not present to sense we exercise the same motor innervation which we do when we actually perceive it and think about it, the only difference being that we do it, as it were, in an internal whisper, or are content with a nascent excitation —in other words, we have the same motor intuitions: in like manner, when we exercise will in thinking, there is always a tension, actual or nascent, of some muscles—either of the ocular muscles, when our eyes look as if they were straining to see or apprehend some distant object; or of the auditory muscles, when we have the appearance of one who is listening to catch a distant sound; or of the muscles of head, nose, forehead and face, when the looker-on can easily read earnest thought in the resulting expression; or in some other of the muscles of the body which persons may have associated with their thinking processes.

In support of this opinion let me instance—first, the feeling of tension in or about the head which is sometimes experienced after long and earnest thought, and which, if augmented, may not only become distressing but may end in giddiness or vertigo, the motor innervation losing its definite co-ordinate character, and discharging its disorderly energy in consciousness; secondly, the frequent association of apparently useless movements with the movements which are necessary for the accomplishment of an act, as, for example, when one who is making a strong exertion with his arms or a delicate operation with his hands distorts or otherwise puts in action the muscles of his face. Such movements have been called sympathetic, as they indeed are, but at the same time it may be justly argued that they actually assist in the performance of the operation, forasmuch as they strengthen the central energy by means of the sensory reflex contributions which they supply through their muscular sense. Lastly, I may adduce the fact that the character of a man's will is written in the character of his physiognomy and of the muscular habit of his body, as evidence that there has been an habitual muscular tension during each operation of will. Just as the history of a man's life is the revelation of his character, testifying to what he has willed, so likewise the features of his body, containing the history of what he had willed, would be found to be an excellent record of character, could we but acquire the skill to interpret the symbols accurately.

If one were required to specify the physical conditions of an act of attention, it would be necessary to begin by the fundamental postulate of an interest in the subject, arising either from ancestral affinities in the individual's nature, or from affinities developed in it in consequence of education or of the particular pursuit in life. After this had been assumed, the requisite conditions might be declared to be these: first, the excitation of the proper ideational track either by external presentation or internal representation; secondly, the intensification of its energy by the increment of stimulus resulting from the proper motor innervation; thirdly, a further intensification of energy by the subsequent reaction of the more active perceptive centre upon the motor factor—the interplay of sensory and motor factors augmenting the activity up to a certain limit; and, lastly, a probable increase in the vascularity of the parts concerned, in consequence of the greater activity of function. Of this last condition I have not yet said anything; but it is probable from these circumstances—that there is a more active circulation of blood through the brain during function than when it is in repose, and that the effect of fixing the attention upon a part of the body is notably sometimes to increase the activity of its circulation. We may fairly conclude, then, that the effect of attention to a current of thought is to quicken the circulation in the nervous subtrata which minister to it; not otherwise than as when some earnest thought has taken hold of the mind, it keeps up an active circulation in the brain, and will not let us go to sleep. It determines an afflux of blood, and the increased afflux of blood sustains the activity; and when sleep is procured, it may be done either by an abatement of thought and a sequent lowering of the circulation, or by a lowering of the circulation and a sequent subsidence of thought. Compare in regard to this action and reaction the phenomena of blushing: an idea which is connected with some feeling of shame causes an immediate dilatation of the vessels of the face and neck, and the individual blushes; thereupon the feeling produced by the blushing reacts upon the idea, and augments his shame and confusion; and the consequence is that he blushes still deeper, and is still more confused.

Bearing the foregoing considerations in mind, let us endeavour to apprehend clearly what is meant by saying that we voluntarily direct attention to a subject of thought in order to reflect upon it. What is accomplished in such case is the excitation of certain nervous currents of ideas, and their maintenance in action until they have called into consciousness, by radiation of energy, all their related ideas, or as many of them as it may be possible, in the then condition of the brain, to stimulate into action. If the reflection be fruitful, a new conception is formed, co-ordinating or holding together the newly discovered relations, which takes its place henceforth in due association with, but on a higher level of abstraction than, the ideas from which it has been developed. The voluntary direction of attention to a subject of thought implies an interest in it arising from some feeling connected with it, or from the desire to understand it, whereby it holds the attention; for if the subject be utterly without interest to us, or if thinking about it fails entirely to stimulate interest by the discovery of any new relations, the attention is sure to wander. In fact, what we do voluntarily is to impart an interest to the subject by bringing suitable motives to bear, augmenting excitation by appropriate stimuli, so that the attention is attracted, or, in other words, consciousness actively aroused, rather than, as common language implies, to direct consciousness to it, and so to keep it before the mind. It would appear then that the force which we mean by attention is rather a *vis a fronte* attracting consciousness than a *vis a tergo* driving it. If this be so, voluntary and involuntary attention differ not in their fundamental nature; the actual difference being that while in reflex or involuntary attention the activity of the thought is such as immediately to arouse and hold consciousness by itself, in voluntary attention the excitation reaches the proper pitch of activity only by help of the increments of energy—the reflex contributions, so to speak—which it receives from associated ideas. In the one case consciousness is aroused to the pitch of attention as a direct reflex act; in the other case, through the intermediate aid of the energies reflected upon the subject of thought from associated ideas.

It is well known that a greater pain causes us to cease to feel a less pain even though the cause of the latter continues in operation; the consciousness is appropriated by the former, and there is none left for the latter at the same moment. In like manner, we are undoubtedly able in some measure to relieve a sharp pain by biting the tongue, or even by spasmodically contracting certain muscles; an inhibitory effect being produced upon the centre in which the pain was felt, and the consciousness being concerned with the sensation from the bitten tongue or with the muscular sensibility of the contracted muscles. When a bodily pain precludes attention to a subject of thought, the stimulated sensory centre exerts an inhibitory effect upon the supreme cerebral centres. We have an instance of the reverse operation when great mental excitement produces an inhibitory anæsthetic effect: a severe wound inflicted during the excitement of battle may not be felt at the time; persons suffering from mania will sometimes sustain or inflict on themselves the severest injuries without apparently feeling the least pain from them; the convulsionists of St. Médard were seemingly insensible to the violent blows, the so-called "consolations," with which the on-lookers vigorously belaboured them. These facts show how localized a function consciousness may be in the brain, and seem to me to suit well with the interpretation which I have given of the nature of attention.

I might mention many other facts which point to the same conclusion, but it will suffice now to call to mind the phenomena of the so-called mesmeric sleep. In this artificially induced state, the person who is the subject of the experiment is sometimes insensible to all sensory stimuli except the sound of the operator's voice, and it is certain that severe surgical operations have been performed without the least indication of suffering. He is unconscious too of all ideas except those which the operator suggests to him, and is accordingly under their influence entirely, their substrata being alone active; cannot sit down if he is told that he cannot sit, or rise from a chair if made to believe that he cannot rise; he becomes, in fact, an automatic machine, dominated by the ideas that are aroused into action. In somnambulism, the person is in like manner unconscious of all ideas except those which constitute his dream, and of all sensations except those which are related to the ideas of his dream. His senses are not closed entirely, but they are only open to such impressions as are in relation with the ideas of the dream; this phenomenon being but an extreme instance of that operation of idea upon sensory ganglia which we have pointed out as increasing the susceptibility of the sense, and producing sometimes actual hallucination. He acts his dream, insensible the while to other sensory stimuli than those which are necessary to enable him to do this; these being commonly, as we should expect, such as are derived from the sense of sight and the muscular sense.(⁸) Probably, were a hound thus to act a dream of hunting, the sense of smell would be alone open to impressions. We have no data to warrant a conjecture as to the actual condition of the brain under these circumstances; but it is not impossible, having regard to the manner of distribution of the arteries, that the state of the circulation of the blood in the brain may be at the bottom of the phenomena. We know that the vessels are contracted, and that much less blood flows through the brain, during sleep, the full force and activity of the circulation being restored when the person awakes; we know, too, that certain arteries supply certain areas of the convolutions; we may conjecture, therefore, that in the dream of the somnambulist the activity of the circulation continues in particular vascular areas, in consequence perhaps of a stimulus from some internal organ which is in relation with that area, and that the functions of these cerebral areas persist partially in consequence. Whether this be the physical explanation or not, it is certain that in these abnormal states of sleep there is a discontinuity of function, portions of the cortical centres being cut off from intercourse with the neighbouring centres, which are in a state of repose, and discharging their function independently of them; the ideas aroused are, for some unknown physical reason, incapable of propagation through neighbouring plexuses.

Let me briefly summarize and bring together the facts which have been mentioned. They are these: that the idea of a certain sensation being about to occur quickens the sense when the impression is made, rendering it both more acute and quick to feel; that in reflection the idea habitually acts upon the sensory centre, becoming more definite by being thus figured to sense; that this downward action of idea upon sense is sometimes so intense as to generate an actual hallucination; that the consequence of the excitation of the sensory centre is a motor innervation; and that in certain anomalous states, when a particular train of mental activity is going on, the senses are open only to such sensations as are in relation with the current of ideas, the person being capable only of attending to these sensations. But this limitation of attention is a strictly physical limitation arising from the isolated excitation of particular ideational currents, and the consciousness is the result, not the cause, of the excitation. The psychological mode of expression puts the cart before the horse; the problem in reflection is not, as it is said, to *direct* consciousness, or to *direct* the attention to an idea, but to *arouse* consciousness of it by stirring it up to a certain pitch of activity. And it is a question of no little importance, whether we can reflect intently without either figuring the ideas to sense, or exciting the associated motor intuitions of the words by which we denote them, and making, as it were, a mental repetition of the word; the sensory representations and the motor intuitions reacting upon one another, enhancing the energy of the percepto-motor current of which the idea is correlative, and so maintaining the attention. I venture at any rate to pronounce the question to be one well deserving of more consideration than it has received.

It remains to say something more concerning the association of ideas. The anatomical connections of a nerve-cell, or of a group of nerve-cells, in the cerebral ganglia do, of necessity, limit the direction and extent of action upon other cells; one cell cannot act on other cells indifferently, for it may be deemed tolerably certain that as the conduction in nerve-fibres demonstrably does not pass from one to another except by continuity of tissue, so the activity of one cell cannot be communicated to another except along an anastomosing process. Before a nerve-cell has formed its connections in the convolutions it can have no part in mental function. Besides, or within, this necessary limitation, which exists in the anatomical constitution of the nervous centres, there is a further determination of the manner of association by the individual life experience, just as is the case with movements. "Not every thought to every thought succeeds indifferently;" but, as all ideas have been acquired by means of experience, and we have "no imagination whereof we have not formerly had sense in whole or in parts," so the connections which ideas have with one another in the brain must answer in some manner the order of experience, and an individual's habit of association of ideas will witness to the influence of his particular education and surroundings. The same topic will give rise in different individuals to as many different trains of thought, each train being the result of a line of suggestion determined by the peculiarity of his temperament, and by the education of his pursuit in life. A rumour of war will arouse anxious ideas respecting the state of the funds or the state of trade in the commercial mind; the politician will immediately bethink himself of the position and prospects of nations; and the soldier's thoughts will be of promotion and honours and military arrangements. Behind the effects of education, however, are those inherited dispositions which have so much weight in determining the character or temperament of the individual; what his forefathers have felt, thought and done, though he has never known them, assuredly has some influence upon what he will be inclined to feel, think and do; he has inherited nervous substrata in his convolutions which are ready to take on, at the appropriate stages of his experience in life, the same kind of function which they displayed in his forefathers.

Social life would simply be rendered impossible if we could not depend upon the uniformity of the laws of nature in man as well as out of him; if one idea followed another not causally but casually, it would be all one as if one event in nature occurred without connection with another. That one idea does seemingly follow another casually, or at any rate without recognisable coherence, justifies us, we are in the habit of thinking, in shutting a man up in a lunatic asylum; and one of the first signs of insanity confessedly is an unaccountable change in, or disruption of, the particular uniformity of an individual character. The foundation of our laws and the maxims of life entirely rest upon the constancy of laws in the human mind; "a prisoner who has neither money nor interest," Hume very aptly says, "discovers the impossibility of his escape as well when he considers the obstinacy of the gaoler as the walls and bars with which he is surrounded; and, in all attempts for his freedom, chooses rather to work upon the stone and iron of the one than upon the inflexible nature of the other." Although ideas are thus as definitely associated in the mind by physical necessity as are cause and effect in external nature, yet, because sometimes one idea has succeeded another in our experience and sometimes another, it is not certain always in so obscure and complex a labyrinth what idea shall in a given case ensue; only this is certain, that it shall be an idea which has been associated with it at one time or another, or has something similar in it—which has had to it relations of contiguity in time or place, or of identity, or analogy, or contrast. Necessity is, in truth, confessed in every deliberation and in every act of our life. When we call up and attend to an idea by means of what is called a voluntary effort, we can only do so by making use of the fixed laws of association; we attain our end not by a sudden and direct command of will, but by pursuing trains of thought likely to lead to the subject which it is desired to recollect: not otherwise than as in willing a complex movement we make use of the organised cohesion in the motor centres. When we are reading, or listening to a conversation, or when the mind is in a state of reverie, associations of ideas go on spontaneously, without any effort of will, and even without consciousness of the train of thought, and we may be surprised to find that an idea sometimes occurs to us in this way through the revival of old associations which seemed to have been lost.

Because each one has a certain specific nature as a human being, and because the external nature in relation with which each one exists is the same, therefore are inevitably formed certain general associations which cannot without great difficulty, or anywise, be dissociated, just as different movements are so linked together in all men that they cannot be dissociated. Such are what have been described as the general laws of association of ideas—those of cause and effect, of contiguity in time and space, of resemblance, of contrast; in all which ways, it is true, one idea may follow another, though also probably in other ways. We are enabled, however, by virtue of the general laws of association in which all men agree, to foresee the general character of human belief, to predict the general course of human conduct, and to establish laws for the regulation of the social state. The universality which is supposed to belong to the fundamental ideas of cause and effect, of the uniformity of nature, of time and space, has been supposed to betray an origin beyond experience, and many subtle and elaborate arguments have been set forth at different times in order to prove that they never could have been acquired by experience only. Nevertheless, it is hard to conceive how men, formed and placed as men are, could have failed to acquire them, and still more hard to conceive how they should ever have been supposed to have any meaning outside or beyond human experience—to have an absolute not a relative truth. The belief in the uniformity of the laws of nature—that the setting sun will rise again, that the leafless trees of winter will put on new foliage in the spring, that the seed committed to the earth will come up in due time as herb or plant, that the rains will descend and the rivers flow in the time to come as they have in time past, that that which has been is that which shall be—is a belief which is developed of necessity in the mind in accordance with the laws of that nature of which it is a part and product. The uniformity of nature becomes conscious of itself, so to speak, in the mind of man; for in man, a part of nature and developing in accordance with natural laws, nature attains to self-consciousness. The belief does not spring up at once in the mind of the individual, but grows gradually as a part and product of its intellectual growth; it is limited at first to some particular instance in which it has its birth, is extended successively to other instances, gaining strength thereby, receives fresh verification from each new instance of uniformity as the mind comes into more intimate and special relations with different parts of nature by the discovery of new facts and laws, and acquires at last such a certainty and universality within human experience that its negation becomes inconceivable to many persons. To say that a thing is inconceivable, let it be noted by the way, is to declare that conception has limits based upon experience, not to limit the possibilities of nature. Is it not true of animals that they, in their limited sphere, base their actions upon an instinctive recognition of or adaptation to the uniformity of nature? It is not probable that they have, like us, the conscious belief, but it is implicitly contained or unconsciously embodied in their simpler mental organization, and is the basis of many of their actions. Were we to conceive a tree to be endowed with self-consciousness, and thus to know that each spring it put forth buds, and in due season produced fruit after its kind, and not after any other kind, it is impossible to conceive that it would not have a conviction of the uniformity of nature; its function as a fruit-bearer after its kind being a special expression of this uniformity. In man himself the instinctive feeling of uniformity is antecedent to the conscious enunciation of the belief; the reasoned utterance is the explicit avowal of what was implicit in the structure of the mental organization.

It by no means follows that the present uniformity of nature will continue for ever because we have a conviction of the reign of fixed and unalterable laws. It is not impossible to conceive a gradual or a violent change taking place in the order of nature, as it is known to us, for it is certain that finite experience will not warrant us in making an induction of eternal uniformity which infinite experience alone could warrant. If it be incredible that a miracle, in the sense of a violation of the laws of nature, has taken place in the past to which the human mind can look back, it is not incredible that the whole course of nature may be changed, and that new laws may come into action, in the future. For anything we know, a great catastrophe might occur at any moment to the earth which is our home, and no one be left to tell the tale of it. The truth is that we are much more apt to believe than to doubt the continued association of events which we have been accustomed to see happen together; in this respect resembling children who accept statements at first without hesitation, and anticipate that what has happened a few times will happen again under like circumstances; and savages, to whom a new experience produces a positive shock and is most unwelcome, and who cannot conceive that any other justification of a belief or custom can be needed than that it was the custom or the belief of their forefathers. An illustration of the same tendency is seen in the hostility to a new idea which is so often exhibited by cultivated individuals and nations, who view with horror the threatened disruption of the accustomed order of their thoughts, and look upon scepticism, which really is a condition of intellectual development, as a most dangerous enemy to the best interests of mankind. To be "wise above that which is written" exposes a man to obloquy as an "infidel" or "unbelieving dog;" and yet it is only by being wise above that which is written that the race progresses.

The conception of the uniformity of nature I hold then to be an induction which has been formed by the human race through experience, and there is good reason to suppose that other fundamental ideas have the same foundation. It is becoming day by day more difficult to understand why there should ever have been such eager and long-standing disputes as have prevailed between the supporters of the doctrine that all knowledge is gained by experience—*à posteriori*, and the supporters of the doctrine that the mind contributes to the result an element which is above experience—*à priori*. In simple perception, as we have seen, the mind, after the first experience, always contributes its element. Had each party resolved to come to a clear and precise understanding of what the other meant by the terms used, one is tempted to think that the dispute must have fallen to the ground.

No one will deny that the construction of the human organism, mental and physical, is such that certain results will ensue when it is placed in certain conditions; when the nipple is put between the new-born infant's lips it will suck, before it has learnt to do so;

when food is put into the mouth, saliva will flow, the food be swallowed, and subsequently digested and assimilated; and, in like manner, when objects and events are presented to the senses there will be formed what are called ideas, and the mind will function along certain definite lines or paths which are known as perception, memory, reasoning, emotion, and volition. In a well-constituted brain, placed under suitable conditions, such results will ensue, nor will they ensue in any brain, however well constituted, unless the external conditions be present; wherefore experience is the essential condition of the development of every kind of knowledge—not less so than air and food are essential to any sort of development of the organism. But just as all the air and food in the world would be useless to the organism, would have no more nutritive effect upon it than upon a statue of bronze, if it had not the power of digestion and assimilation, so all the objects in the world might be presented in vain to senses capable of their respective functions, if the brain had not a power of appropriating the effects in the development of the various functions of its mental organization. The idiot, like the animal, may see, hear, smell, taste, feel, and yet be incapable of reasoning to the end of its life. It is plain, then, that the brain or mind does contribute an essential factor to the result which we call knowledge, call this factor what we will.

Let it not be overlooked, moreover, that the lines of mental function in man are as definite, as necessary, as the lines of instinct in bees or ants; we cannot do otherwise than perceive, remember, reason, feel as other men do—cannot transcend these lines any more than we can transcend the modes in which other men move. Bees and ants appear stupid when taken out of the tracks of their instincts, because they cannot adapt themselves to unfamiliar experiences to which we with our superior insight perceive the easiest modes of adaptation. We in like manner should appear not less stupid if taken out of the automatic grooves of our mental functions, to a higher order of beings furnished with senses capable of unveiling varied and complex processes of nature that are utterly inaccessible to us, and endowed with such superior and more varied mental faculties as would enable them to co-ordinate the variety of impressions into a unity of effect. When in olden times twenty men laboured hard to accomplish that which one man can now, in consequence of discoveries in mechanics, do with comparative ease, it would have seemed to one watching them, who was possessed of these discoveries, gross stupidity that they should go on automatically in their routine of thought and action, and fail to perceive the means of instant relief which lay close at hand.

Admitting that the mind contributes an essential factor in the development of knowledge, the question is as to the nature of this mental factor. All the varieties of mankind have the same general type of cerebral conformation; they have the same number and kind of senses, and the same mechanisms of movements, which act in an uniform manner; therefore they have certain common fundamental ideas. But when the mental phenomena of one of the lowest savages are contrasted with those of an intelligent European, a very wide difference is perceived, notwithstanding that some are common to both; and if a savage child and an European child were subjected to the same external conditions from the first moment of life to the age of fullest vigour, it cannot be doubted that there would still be a vast difference between their mental phenomena. The matter is not one of external conditions alone, of mere acquisition by experience; acquisition implying a power to acquire, and the difference in the two cases being the consequence of differences in the native powers of acquisition. It is evident then that the value of the connate mental factor in a process of knowledge differs much in different human beings, and that the knowledge which some men are capable of acquiring cannot be acquired by other men, however similar the conditions of life, any more than the extraordinary height of stature or weight of body which one man reaches can be reached by all men.

If it be affirmed by those who uphold the *à priori* origin of certain ideas that the same fundamental forms are imposed by the mind upon the materials of its knowledge in every case, and that the difference in the value of the mental factors contributed is one of degree only, it will still be a question whence the different degree of value possessed by one individual over another has been derived. The obvious answer is that the native superiority of organization is the result of inheritance.* The savage has a less capacity of acquiring knowledge than the European, because his brain is fashioned after the less developed type of the brains of his forefathers, while the European inherits the superior organization and capacity of the brains of his forefathers: the *plus* mental factor contributed by the latter is a native endowment inherited from ancestors and independent of his individual experience. He has nervous substrata in his convolutions which the savage has not. We have no more reason to doubt this than to doubt that the pointer dog is indebted to inheritance for the facility with which it learns to point. So far, then, those who uphold the *à priori* doctrine are right in asserting that all knowledge does not come to the individual from the senses, but that the constitution of mind imposes upon the materials supplied by the senses forms or intuitions which are an important element in the result—in other words, determines the lines of necessary function.

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* In the first edition of his great work on the *Origin of Species*, published in 1859, Mr. Darwin said—"Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation," p. 488; foreseeing at that time, as Mr. Huxley has remarked, that man and his highest faculties are as much products of evolution as the humblest plant. "Every kind of improvement, static or dynamic, that has been realised in the individual tends to perpetuate itself by generation in the species. Thus by heredity modifications that were at first artificial are rendered spontaneous." (COMTE, *Positive Polity*, vol. i., p. 493, Eng. Translation). He points out how this results necessarily in the gradual elevation of the race, insisting notwithstanding on the fixity of species.

We are now brought to another question: whether these forms, intuitions, fundamental ideas, categories of the understanding, mental aptitudes, or by whatever other name they may be called, have not themselves been acquired by experience, not of the individual but of the race, not of the unit but of the organism of mankind. It is a fundamental principle of the Darwinian theory that advantageous bodily and mental modifications which arise from the tendency to the formation of variations are inherited, and that thus by the accumulation of modifications through countless generations the mental faculties of man have been acquired by gradation. Time was, we know, when Europe was overrun by beings who were no higher than existing savages, and who, could we imagine them living in the complex social system of to-day, would be as much out of place, as little able to adapt themselves to it and to acquire what such adaptation implies, as the savage; nevertheless they were our ancestors. All the mental endowments, therefore, in which we surpass them and all the superiority of cerebral organization which such endowments imply, have been acquired by the accumulated effects of experience and their transmission through generations. They are the organically registered results of the more complex and special relations between man and nature which have been gradually effected through the ages; wherefore they determine the forms of his thinking and feeling, not otherwise than as the conformation and disposition of the muscles determine the manner of his walking. They are independent of the experience of the individual, but not of the experience of the race.

To acquire a knowledge of the *genesis* of these higher native capacities of mind, induction must begin with mind in its most primitive state, not, as metaphysicians do, with mind in its most complex and highly developed state. It will be found that factors which appear to be ultimate and incapable of analysis in the latter are neither ultimate nor incapable of analysis when we study their organic evolution. They make a vital mistake who, separating mind from nature and its laws by an impassable barrier, reject the doctrine of mental evolution, instead of identifying mind with the organism and proceeding to enquire patiently into the common laws of their evolution. We grant them the general potentialities of feelings and ideas which they call mental forms, the *à priori* forms of space, time, causality, moral sense, but we go back to trace their origin and evolution in the race, just as we trace the origin and evolution of the more special forms of feeling and thought which are manifested by each individual in consequence of his special inheritance. The constancy and universality of the general forms or categories of thought and feeling are no more wonderful than it is wonderful that all men should see, hear, taste, smell and feel in the same way; they have been fashioned, as the senses have been fashioned, by progressive internal adaptation to external conditions through the long records of ages.

When the Darwinian doctrine of evolution is thus applied to mind, the dispute between those who take the *à priori* side and those who take the *à posteriori* side might seem to be at an end. But it is not; the argument of the former, when pursued to its logical consequences, being that the connate mental forms have not been derived from experience at all; that they are really of supersensible origin, antecedent to and transcending all experience alike of the race and of the individual. That our senses never have made us, nor do now make us, nor, being what they are, ever can make us acquainted with more than a very small part of nature, is a proposition which cannot be seriously disputed. Assuredly what we learn concerning the processes of nature by any sense is but a small fraction of what we do not learn and is to be learned. But it is necessary here to distinguish between that which lies beyond the reach of our senses because of their limitation, but of which our senses might give us information if they could be brought into relation with it, and may some day give us information, and that which could not in any case be known through sense, but which is assumed to be known through a faculty of intellectual intuition, ecstatic contemplation, or spiritual insight. The question is whether man has or ever had any such extraordinary faculty of gaining ideas from a higher source, and of greater validity, than those which are gained through experience; in other words, whether he is ever endowed with a supersensible sense which brings him into relations with the infinite and absolute. Let the faculty be admitted for argument's sake; it would not then follow necessarily that the so-called fundamental ideas about which the present dispute is were acquired through it; on the contrary, it might still be argued that they were inductive acquisitions of the race, could be clearly traced as such in its development, and had only the validity of inductions; and I know not how the argument could be successfully encountered. It is obvious, however, that argument of any kind would be the idlest waste of labour in face of a capacity of receiving supersensible revelations, a faculty of sublime intuition; those who possess it moving in an intellectual sphere to which the common processes of reasoning cannot reach. But if man's superiority to other animals lies in his higher and more complex organism, and if his mind, like animal mind, is a function of organization, a part of nature the evolution whereof implies the most complex and subtle combinations of matter and corresponding complexities of energy, then the terms of such a discussion are meaningless imbecilities. Supersensible intuition belongs to the same order of ideas as supersensible pregnancy; and one might as well discuss the foolish question whether pregnancy is ever of supersensible origin.

Within the general forms of thought which are common to all men there are numerous subordinate differences; the special character of an individual's association of ideas being determined partly by his original nature, and partly by his special education and life-experience. That natural differences in the mental susceptibilities of different persons do influence the character of their association of ideas, is shown, as Dr. Priestley long since pointed out,* by the greater ease with which some men associate those co-existences of sensory perceptions which combine to constitute the idea of an *object*, while others associate more readily those successive sensory impressions which go to form the idea of an *event*. These different tendencies and dispositions are really at the foundation of two different types of mind. In the former case, there is a mind attentive to the discrimination of impressions, skilful in discernment, and susceptible to the pleasurable and painful properties of things—in fact, a mind good at description, and fond of natural history; in the latter case, there is a mind observant of the order of occurrence of phenomena, prone to the investigation of the genesis of things, or the connection of cause and effect—in fact, a philosophic intellect, affecting science and abstract truth, to which an event that can be nowise explained or displayed as an evolution of antecedent causes is a painful tribulation. Such mind is at the opposite end of the scale to that of the "poor idiot born," who, by reason of his defective cerebral constitution, has but few ideas, and cannot duly associate those few, just as he is capable of but few imperfectly associated movements. Forget not, however, that between the idiot at the bottom of the scale of human life, and the philosopher at its summit, there are to be met with beings representing every grade of the transition.

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* In his Introduction to Hartley.

Special adaptations to particular circumstances of life also concur to lay the foundation of individual habits of thought and conduct; the direction of such habits being sometimes determined in the first instance by the susceptibility of a particular sense, whereby it is affected pleasurably by certain impressions. The successful tact or skill of one man in circumstances in which the awkwardness or failure of another is striking, is the consequence of a rapid association of ideas which has, from repeated special experience, become so familiar, so much a habit, as to appear like an intuition. In such case the group or series of ideas is so closely united, so firmly organized, as to behave almost as *one* idea; while the excitation, though sufficient for the desired end, does not rise to such a height as to produce consciousness.* There is a coalescence or integration of ideas into a compound idea, just as there is a coalescence or integration of sensations in the idea; and so completely, that just as it is difficult sometimes to analyse the idea into its compound sense-elements, so it is difficult to analyse the complex compound idea into its component single ideas. Without these groups of coalesced ideas, which, as before said, may be compared with combinations of movements that are acquired at first by practice and afterwards put in action by an impulse of will as easily as a simple movement, it would be necessary on each occasion of thinking to go through the elementary process of acquiring them, just as a child must at first go through the elementary process of spelling the separate letters in a word or the separate words in a sentence, which he can afterwards dispense with, and no progress in mental development would be possible. The more of these complex ideas there are organized in the mind, the more quick, free and skilful will the thinking be. Even the instantaneous and acute judgment of a much experienced and well-trained mind, which is sometimes so rapid as to look like an instinct or intuition, is founded upon a previous careful training in observation and reflection; it depends in reality on an excellent association of ideas that has been organized in correspondence with, or adaptation to, the co-existences and successions in external nature; and thus it comes to pass that even the judgment of an individual in his particular relations of life becomes almost automatic.

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* "Not only do simple ideas, by strong association, run together, and form complex ideas; but a complex idea, when the simple ideas which compose it have become so consolidated that it always appears as one, is capable of entering into combinations with other ideas, both simple and complex. Thus two complex ideas may be united together by a strong association, and coalesce into one, in the same manner as two or more simple ideas coalesce into one. This union of two complex ideas into one, Dr. Hartley has called a duplex idea. Two also of these duplex ideas, or doubly compounded ideas, may unite into one; and these, again, into other compounds without end." . . . . . "How many complex or duplex ideas are

When it is said, again, that a man's character is completely formed, we express thereby the fact that he has acquired certain definite combinations and associations of ideas which, firmly organized, henceforth avail

all united in the idea of furniture? How many more in the idea of merchandise? How many more in the idea called Every Thing?" —J. Mill, *op. cit.* p. 82.

him in the different circumstances of life. Could we unravel backwards the complexities of his mental fabric, or decompose it by gradual steps in the retrograde order of its composition, we should disclose the successive steps of his gradually progressing adaptation to the complex circumstances of his surroundings: we should have the history of his life-experience, in the reverse order of its acquisition, laid bare in the unwinding of his mental plexuses. It is evident, then, that if we had a complete knowledge of the inner nature of an individual, if we could penetrate that most exquisitely organized fabric of thought which by reason of his particular education and life-experience has been grafted on the original capabilities, it would be possible to foretell with certainty his mode of thought and conduct under any given circumstances. Is not this a prediction which, as it is, those who know a man best can often make with close approximation to truth? But inasmuch as no two minds are exactly alike originally, and as no two persons have precisely similar experiences, the specialities of human conditions being infinite in variety, we cannot obtain the exact and complete elements for a correct and definite judgment respecting the operation of a given cause upon any individual. None the less true is it that every cause does operate definitely by as stern a necessity as any which exists in physical nature.

Once more, then, it is rendered evident how necessary to a complete psychology of the individual is the consideration of the circumstances in which he has lived and in relation to which he has developed, as well as the observation of his habits of thought, feeling, and action. From what has been said of ideas and their associations, it is obvious that in the same language, when used by different people, there must often be considerable difference in regard to the fulness and exactness of the ideas conveyed by it. (9) In translation from one language to another it plainly appears that ideas which have a general resemblance have yet certain special differences according to the depth of thought, the religion, the manners, the customs of the different nations; it is as hard a matter to convey adequately in the French language the meaning of German philosophy as it is to express adequately, by the corresponding German words, the exact meaning of the French names for different shades of elegant vice or elegant cookery. And whosoever enters upon the study of psychology with the assumption that an idea deemed or called the same has the same constant value in different people of the same nation, will be led into the vainest errors by so false a metaphysical conception. Do not men owe most of their errors and disputes to the fact that they cannot come to a right understanding of words? How should they, indeed, when the same word frequently signifies an idea at very different stages of its evolution?

It remains only to add here, that the successive formation of ideas in mental development and the progressive complexity of their association and of their interaction in the supreme centres of the brain illustrate, as do the development of the spinal centres and the development of the sensory centres, an increasing organic specialization in the relations of man to external nature; that the law of progress from the general and simple to the special and complex has sway here as elsewhere in organic development.

Thus far, then, we have exhibited the path of distribution for the energy of an idea when it does not pass outwards in a direct reaction to the stimulus from without: it travels from cell-group to cell-group within the cortical layers of the hemispheres, and thus gives rise to *reflection*. But at the end of all this wandering or of the various transformations, as the final result of reflection, there may still be a reaction downwards and consequent outward activity of the individual. When that takes place it is *volitional* action. The will, abstractly speaking, is the resultant of the complex interaction of the supreme ganglionic cerebral plexuses; these constituting a complicated mechanism which intervenes between the ingoing and the outgoing currents. We ascend gradually to this highest manifestation of force by tracing upwards the fundamental reaction of nerve-cell through reflex action, sensori-motor action, and ideo-motor action: in our knowledge of the more simple phenomena we obtain a light which lightens the path of study of phenomena which are more complex and obscure. As, however, there is present in the action of will some desire of a good to be obtained or of an evil to be shunned, which imparts its driving force, it will be proper, before considering the nature of volition, to deal with the emotions. To them, therefore, shall the next chapter be devoted.

NOTES.

[1] (*p.* 277).—"I cannot but think that the two main articles of belief which have been set down to the credit of the Indian—namely, the Great Spirit or Creator, and the Happy Hunting-grounds in a future world,—are the results of missionary teaching, the work of the Fathers Hennepin, Marquette, and their noble army of martyred Jesuit followers." . . . . The Manitou, which we are obliged to translate "Spirit," exists everywhere; they believe there is a manitou in water, in fire, in stars, in grass, &c.; it is the essence of Fetishism. "It is doubtful whether these savages ever grasped the idea of a human soul." . . . . "I do not believe that an Indian of the plains ever became a Christian. He must first be humanized, then civilized, and, lastly, Christianized; and, as has been said before, I doubt his surviving the operation."—*The City of the Saints*, by R. F. Burton, p. 133.

[2] (*p.* 277).—"There is no other act of man's mind that I can remember, naturally planted in him, so as to need no other thing in the exercise of it, but to be born a man and live with the use of his five senses. Those other faculties of which I shall speak by and by, and which seem proper to man only, are acquired and increased

by study and industry, and of most men learned by instruction and discipline; and proceed all from the invention of word and speech." HOBBES, *Leviathan*, ch. iii.

[3] (*p.* 278).—"The first consideration I have upon the subject of the senses is that I make a doubt whether or no man be furnished with all natural senses. I see several animals who live an entire and perfect life, some without sight, others without hearing; who knows whether to us also, one, two, three, or many other senses may not be wanting? For if any one be wanting, our examination cannot discover the defect." "'Tis the privilege of the senses to be the utmost limit of our discovery; there is nothing beyond them that can assist us in exploration, not so much as one sense in the discovery of another." . . . .

"There is no sense that has not a mighty dominion, and that does not by its power introduce an infinite number of knowledges. If we were defective in the intelligence of sounds, of harmony, and of the voice, it would cause an unimaginable confusion in all the rest of our science; for, besides what belongs to the proper effect of every sense, how many arguments, consequences, and conclusions, do we draw to other things, by comparing one sense with another? Let an understanding man imagine human nature originally produced without the sense of seeing, and consider what ignorance and trouble such a defect would bring upon him, what a darkness and blindness in the soul; he will then see by that of how great importance to the knowledge of truth the privation of such another sense, or of two or three, should we be so deprived, would be. We have formed a truth by the concurrence of our five senses; but, perhaps, we should have the consent and contribution of eight or ten to make a certain discovery of it in its essence."—MONTAIGNE'S *Essays*.

[4] (*p.* 278).—"For what is meant by innate? If innate be equivalent to natural, then all the perceptions and ideas of the mind must be allowed to be innate or natural, in whatever sense we take the latter words, whether in opposition to what is uncommon, artificial, or miraculous. If by innate be meant contemporary to our birth, the dispute seems to be frivolous; nor is it worth while to inquire at what time thinking begins, whether before, at, or after our birth. Again, the word *idea* seems to be commonly taken in a very loose sense by Locke and others as standing for any of our perceptions, our sensations and passions, as well as our thoughts. Now, in this sense, I should desire to know what can be meant by asserting that self-love, or resentment of injuries, or the passion between the sexes, is not innate?"—HUME, *Essay Concerning the Human Understanding*.

[5] (*p.* 288).—The following is Dr. Cheyne's description of Colonel Townshend's case:—"He told us that he had sent for us to give him some account of an odd sensation he had for some time observed and felt in himself; which was that, composing himself, he could die or expire when he pleased, and yet, by an effort, or somehow, he could come to life again, which, it seems, he had sometimes tried before he sent for us. We all three felt his pulse: it was distinct, though small and thready, and his heart had its usual beating. He composed himself on his back, and lay in a still posture for some time; while I held his right hand, Dr. Baynard laid his hand on his heart, and Mr. Skrine held a clean looking-glass to his mouth. I found his pulse sink gradually, until at last I could not feel any by the most exact and nice touch. Dr. Baynard could not feel the least motion in his heart, nor Mr. Skrine discern the least soil of breath on the bright mirror he held to his mouth. Then each of us by turn examined his arm, heart, and breath, but could not by the nicest scrutiny discover the least symptom of life in him. This continued about half-an-hour. As we were going away (thinking him dead), we observed some motion about the body, and upon examination found his pulse and the motion of his heart gradually returning; he began to breathe gently and speak softly." In the evening of that day the colonel really died.

[6] (*p.* 304).—"The decay of sense in men waking is not the decay of the motion made in sense, but an obscuring of it, in such manner as the light of the sun obscureth the light of the stars; which stars do no less exercise their virtues, by which they are visible, in the day than in the night. But because among many strokes which our eyes, ears, and other organs receive from external bodies, the predominant only is sensible; therefore, the light of the sun being predominant, we are not affected with the action of the stars."—*Leviathan*, ch. vi.

[7] (*p.* 307).—"The time taken up in performing an idea is likewise much the same as that taken up in performing a muscular motion. A musician can press the keys of a harpsichord with his fingers in the order of a tune he has been accustomed to play in as little time as he can run over these notes in his mind. So we many times in an hour cover our eyeballs, without perceiving that we are in the dark; hence the perception or idea of light is not changed for that of darkness in so small a time as the twinkling of an eye, so that, in this case, the muscular motion of the eyelid is performed quicker than the perception of light can be changed for that of darkness."—*Zoonomia*, vol. i. p. 24.

[8] (p. 320).—In the *Union Médicale* of July 21st and 23rd, 1874,

Dr. E. Mesnet relates the particulars of an interesting case of automatic mental action. His paper is entitled "De l'Automatisme de la Mémoire et du Souvenir dans le Somnambulisme pathologique."

A sergeant in the French army, aged 27 years, was wounded at the battle of Bazeilles by a bullet, which fractured the left parietal bone. He had power enough to thrust his bayonet into the Prussian soldier who wounded him, but almost at the same instant his right arm, and soon afterwards his right leg, became paralysed. He lost consciousness, and only recovered it at the end of three weeks, when he found himself in hospital at Mayence. Right hemiplegia was then complete.

By the end of a year he had regained the use of his side, a slight feebleness thereof only being left. Some three or four months after the wound, peculiar disturbances of the brain manifested themselves, which have recurred since periodically. They usually last from fifteen to thirty hours, the sound intervals between them varying from fifteen to thirty days. These alternating phases of normal and abnormal consciousness have continued for four years. In his normal condition, the sergeant is intelligent, and performs satisfactorily the duties of a hospital attendant. The transition to the abnormal state is instantaneous. There is some uneasiness or heaviness about the forehead, which he compares with the pressure of an iron band, but there are no convulsions, nor is there any cry. He becomes suddenly unconscious of his surroundings and acts like an automaton. His eyes are wide open, the pupils dilated, the forehead is contracted, there is an incessant movement of the eyeballs, and a chewing motion of the jaws. In a place to which he is accustomed, he walks about freely as usual, but if he be put in a place unknown to him, or if an obstacle is put in his way, barring his passage, he stumbles gently against it, stops, feels it with his hand, and then passes on one side of it. He offers no resistance to being turned this way or that, but continues his walk in the way in which he is directed. He eats, drinks, smokes, walks, dresses and undresses himself, and goes to bed at his usual hours. He eats voraciously, and without discernment, scarcely chewing his food at all, and devours all that is set before him without showing any satiety. General sensibility is lost; pins may be run into his body, or strong electric shocks sent through it, without his evincing the least pain. The hearing is completely lost; noises made close to his ears do not affect him. The senses of taste and smell are lost; he drinks indifferently water, wine, vinegar, assafœtida, and perceives neither good nor bad odours. The sense of sight is almost, but not quite, lost; on some occasions he appears to be in some degree sensible to brilliant objects, but he is obliged to call the sense of touch to his aid in order to apprehend their nature, form, and position; they produce only vague visual impressions, which require interpretation into the language of touch. The sense of touch alone persists in its integrity; it seems, indeed, to be more acute than normal, and to serve, almost exclusively, to maintain his relations with the external world. When he comes out of the attack, he has no remembrance whatever of what has happened during it, and expresses the greatest surprise when told what he has done.

Through the tactile sense, trains of ideas may be aroused in his mind, which he immediately carries into action. On one occasion, when walking in the garden under some trees, he dropped his cane, which was picked up and put into his hand. He felt it, passing his hand several times over the curved handle, became attentive, seemed to listen, and suddenly cried out, "Henri," and a little while afterwards, "There they are, at least twenty of them; we shall get the better of them!" He then put his hand behind his back, a sif to get a cartridge, went through the movements of loading his musket, threw himself full length upon the grass, and concealing his head behind a tree, after the manner of a sharp-shooter, followed, with his cane to his shoulder, all the movements of the enemy whom he seemed to see. This performance, provoked in the same way, was repeated on several occasions. It was probably the reproduction of an incident in the campaign in which he was wounded. "I have found," says Dr. Mesnet, "that the same scene is reproduced when the patient is placed in the same conditions. It has thus been possible for me to direct the activity of my patient in accordance with a train of ideas which I could call up by playing upon his tactile sensibility at a time when none of his other senses afforded me any communication with him."

All the actions of the sergeant, when in his abnormal state, are either repetitions of what he does every day, or they are excited by the impressions which objects make upon his tactile sense. Arriving once at the end of a corridor where there was a locked door, he passed his hands over the door, found the handle, took hold of it and tried to open the door. Failing in this, he searched for the keyhole, but there was no key there; thereupon he passed his fingers over the screws of the lock, and endeavoured to turn them, with the evident purpose of removing the lock. Just as he was about to turn away from the door, Dr. Mesnet held up before his eyes a bunch of seven or eight keys; he did not see them; they were jingled loudly close to his ears, but he took no notice of them; they were then put into his hand, when he immediately took hold of them, and tried one key after another in the keyhole without finding one that would fit it.

Leaving the place, he went into one of the wards, taking on his way various articles with which he filled his pockets, and at length came to a little table which was used for making the records of the ward. He passed his hands over the table, but there was nothing on it; however, he touched the handle of a drawer, which he opened, taking out of it a pen, several sheets of paper and an inkstand. The pen had plainly suggested the idea of writing, for he sat down, dipped it in the ink and began to write a letter, in which he recommended himself to his commanding officer for the military medal on account of his good conduct and his bravery. There were many mistakes in the letter, but they were exactly the same mistakes in expression and orthography as he was in the habit of making when in his normal state. From the ease with which he traced the letters, and followed the lines of the paper, it was evident that his sense of sight was in action, but this was placed beyond doubt by the interposition of a thick screen between his eyes and his hand; he continued to write a few words in a confused and almost illegible manner, and then stopped without manifesting any impatience or discontent. When the screen was withdrawn, he finished the uncompleted line and began another. Another experiment was made: water was substituted for the ink. When he found that no letters were visible, he stopped, tried the tip of his pen, rubbed it on his coat sleeve, and then began again to write with the same results. On one occasion he had taken several sheets of paper to write upon, and while he was writing on the topmost sheet it was withdrawn quickly. He continued to write upon the second sheet as if nothing had happened, completing his sentence without interruption, and without any other expression than a slight movement of surprise. When he had written ten words on the second sheet, it was removed as rapidly as the first; he finished on the third sheet the line which he had begun on the second, continuing it from the exact point where his pen was when the sheet was removed. The same thing was repeated with the third and fourth sheets, and he finished his letter at last on the fifth sheet, which contained his signature only. He then turned his eyes towards the top of this sheet, and seemed to read from the top what he had written, a movement of the lips accompanying each word; moreover, he made several corrections on the blank page, putting here a comma, there an *e*, and at another place a *t*; and each of these corrections corresponded with the position of the words that required correction on the sheets which had been withdrawn. Dr. Mesnet concludes from these experiments that sight really existed, but that it was only roused at the instance of touch, and exercised only upon those objects with which he was in relation through touch. After he had finished his letter the sergeant got up, walked down to the garden, rolled a cigarette for himself, sought for his match-box, lighted his cigarette and smoked it. When the lighted match fell upon the ground, he extinguished it by putting his foot upon it. When the cigarette was finished he began to prepare another, but his tobacco pouch was taken away, and he sought in vain for it in all his pockets. It was offered to him, but he did not perceive it; it was held up before his eyes, but he took no notice of it; it was thrust under his nose, but he did not smell it; when, however, it was put into his hand he took it, completed his cigarette directly and struck a match to light it. This match was purposely blown out, and another lighted one was offered to him, but he did not perceive it; even when it was brought so close to his eyes as to singe a few eyelashes he did not notice it, neither did he blink. When the match was applied to the cigarette he took no notice, and made no attempt to smoke. Dr. Mesnet repeated this experiment on several occasions, and always obtained the same results. The sergeant saw his own match, but saw not the match which Dr. Mesnet offered to him. There was no contraction of the pupil when the lighted match was brought close to the eye. He had once been employed as a singer at a café. In one of his abnormal states, he was observed to hum some airs which seemed familiar to him, after which he went to his room, took from a shelf a comb and looking glass, combed his hair, brushed his beard, adjusted his collar, and attended carefully to his toilet. When the glass was turned round, so that he only saw the back of it, he went on as if he still saw himself in it. On his bed there were several numbers of a periodical romance; these he turned rapidly over, apparently not finding what he wanted. Dr. Mesnet took one of these numbers, rolled it up so as to resemble a roll of music and put it in his hand, when he seemed satisfied, descended the stairs, and walked across the court of the hospital towards the gate. He was turned round, when he started off in the new direction given to him, entering the lodge of the door-keeper, which opened into the hall. At this moment the sun shone brightly through a window in the lodge, and the bright light evidently suggested the footlights of the stage, for he placed himself before it, opened the roll of paper, and sang a patriotic ballad in an excellent manner. When he had finished this he sang a second and a third, after which he took out his handkerchief to wipe his face. A wine glass containing a strong mixture of vinegar and water was offered to him, of which he took no notice, but when it was put into his hand he drank it off without exhibiting any sign of an unpleasant sensation. Dr. Mesnet propounds the question whether in this perfect rendering of the three ballads he heard his own voice, or whether the singing was purely as automatic as his other actions. The attack came to an end before they could make an experiment to test this question. When the sergeant is in his abnormal state, it is impossible to awaken him to his normal state, whatever efforts be made. No effect is produced either by stimulation or by strong electrical currents. On one occasion he was seized suddenly by the shoulders and thrown violently upon the grass; he manifested no emotion, but, after feeling the turf with his hands, raised himself again, calm and impassive.

A remarkable feature in the case is that the sergeant becomes a veritable *kleptomaniac* during the attacks. He purloins everything that he can lay his hands on, and conceals what he takes under the quilt, the mattress, or elsewhere. This tendency to take and hide has shown itself in each attack. He is content with the most trifling articles, and if he finds nothing belonging to some one else to steal, he hides, with all the appearance of secresy, although surrounded at the time by persons observing him, various things belonging to himself, such as his knife, watch, pocket-book. His other actions during an attack are repetitions of his former habits; these acts of stealing are not so.

If I understand Dr. Mesnet correctly, he is acquainted with another individual who contrives means for committing suicide when he is in an abnormal somnambulistic state. "I have been present," he says, "at two attempts at suicide, one by poisoning, the other by hanging, which I have allowed to proceed to the extreme limit of an experiment, having cut the cord at the moment of asphyxia." He surmises that another person might in the same way perpetrate homicide or become an incendiary, not knowing what he was doing at the time, and not remembering, after the attack had passed off, what he had done.

The resemblance between the sergeant's abnormal states and those transitory attacks of epileptic unconsciousness during which the patient, unconscious of surrounding objects, continues automatically the act which he was engaged in at the time of his seizure, will be apparent. In this relation it is interesting to note that Dr. Darwin, the distinguished author of the *Zoonomia*, called attention long ago to the affinity between epilepsy and somnambulism.

[9] (*p.* 337).—"It will easily appear from the observations here made upon words, and the associations which adhere to them, that

the languages of different ages and nations must bear a general resemblance to each other, and yet have considerable particular differences; whence any one may be translated into any other, so as to convey the same ideas in general, and yet not with perfect precision and exactness. They must resemble one another because the phenomena of nature, which they are all intended to express, and the uses and exigencies of human life, to which they minister, have a general resemb'ance. But then, as the bodily make and genius of each people, the air, soil, and climate, commerce, arts, science, religion, &c., make considerable differences in different ages and nations, it is natural to expect that the languages should have proportionable differences in respect of each other."—HARTLEY'S *Theory of The Human Mind*, by Dr. Priestley.

"Wherefore, as men owe all their true ratiocination to the right understanding of speech, so also they owe their errors to the misunderstanding of the same; and as all the ornaments of philosophy proceed only from men, so from man also is derived the ugly absurdity of false opinions. For speech has something in it like to a spider's web (as it was said of old of Solon's laws), for by contexture of words tender and delicate wits are ensnared and stopped; but strong wits break easily through them."—HOBBES, vol. i. p. 36.

CHAPTER VI.

THE EMOTIONS OR AFFECTIONS OF MIND.

MAN is patient and agent; he suffers certain passions and does certain actions. A calm deliberation involves an equilibrium between suffering and doing, between the individual and his surroundings; but in so far as an idea is attended with some feeling, whether of pleasure or of pain, or of a more special character, it is to that extent emotional; and if the feeling preponderate, the idea is obscured and the state of mind is then called an emotion or a passion. The definite *form* of the idea in the material substratum is obscured or partially lost in the agitation or *commotion* of the nerve elements. Every definite emotion involves the presence of a more or less clear idea of object or event, either presentative or representative, wherefore it cannot be separated from the idea; and the idea, being rooted in sensation, always contains some feeling, even if only a feeling that it is agreeable or disagreeable. In the simplest mental experience there is a subjective as well as an objective element; for in the earliest perception there is feeling. Strictly speaking, all conscious psychical states are, at first, *feelings;* but, after having been experienced several times, they are adequately and definitely organized, and become almost automatic or indifferent under ordinary circumstances. So long as the ideas or mental states are not adequately organized in correspondence with the individual's external relations, more or less feeling will attend their excitation: they will, in fact, be more or less emotional. When the equilibrium between the subjective and objective is duly established, there is no passion and there is but little emotion.(¹) A person who is governed by his feelings is much like one who should live in the stage of simple sensation without going on to the higher stage of perception; and as the stronger the sensation the less exact and complete is the perception, so the more active the emotion the less adequate is the cognition.

It has been the custom to write of the phenomena of the human mind as if they stood quite apart from other natural phenomena, belonged to an order of their own, and did not conform to the order of nature; as if man were a law unto himself, exercising an authority independent of nature, whose function was to control, not to conform to, its order. But he has no such independent authority; he controls only by conforming, conquers only by obeying; he is controlled in spite of himself if he does not conform, yielding painfully through suffering an obedience which he might yield cheerfully through wise action. Emotions, good or bad, are physical phenomena which have their roots in the organic life, conform to natural laws in their origin, nature and expression, and must be studied and discussed like other natural phenomena. With a boldness and thoroughness which horrified metaphysicians, Spinoza treated of human actions, appetites and emotions after the geometrical method, precisely as if they were questions of lines, planes and solids. While recognising the service which he did to philosophy by insisting upon their being put in the same order with other natural phenomena and studied by the same methods, one can easily see now that the exact method was not suited to such complex phenomena, and that the best hope of fruitful results lies in the careful adoption of the inductive method of inquiry.

Emotions betray their physical nature by their name, which has been given them because of their being movements of mind and body; the name is really an induction embodying the experience of mankind, the old name of *commotions* which they had evincing this still more plainly. They act more powerfully upon the organism than ideas, because they represent a more violent internal movement, and because the whole system of the organic life is more deeply implicated in their origin, nature and expression. To all appearances a violent emotion may act sometimes in the same way as a strong physical shock to the nervous system, for it may produce in some instances convulsions, fainting, loss of sensation, paralysis of movement, deafness; exactly the effects which a strong electric shock may produce. We have not then to do with mysterious self-determining agencies: we have to do with phenomena which, complex as they unquestionably are, will eventually receive a complete analysis.

It has been sufficiently evident, up to the present point, that the condition of the nervous centres is of the greatest consequence in respect of the formation of the so-called mental faculties, and of the manifestation of their functions; it will now be seen that this condition is of still more manifest importance in regard to the phenomena of the emotions. Every one's experience teaches him that an idea which is at one time indifferent, being accompanied by no feeling of pleasure or discomfort, may, at another time, be attended by some feeling of discomfort, or become positively painful. And it requires no very attentive observation of men to discover that different persons are very differently affected by one and the same object, and often pass very different judgments upon it in consequence. So much is this the case that we are in the constant habit of distinguishing men by the difference of their emotional disposition or of the temper of their minds, and of speaking accordingly of one man as timid, of another as courageous, of one as irritable and quick-tempered, of another as even-tempered and placid. One of the earliest symptoms of an oncoming insanity, and one that is almost universally present as the expression of a commencing deterioration, howsoever caused, of the nervous centres, is an emotional disturbance, upon which follows more or less perversion of judgment. It is feeling or the affective life that reveals the essential nature of the man; it lies deeper in his nature than intellect, as the organic life lies beneath animal life; it expresses the fundamental tone of his nerve element, which again is the result of its actual constitution or composition, inherited and acquired.

The first occurring observation which, following Spinoza, Unzer, and Müller, I shall make, is, that an idea which is favourable to the impulses or strivings of the individual, to self-expansion, is accompanied by a feeling of more or less pleasure; and that an idea which betokens individual restriction, being opposed to the expansion of self, is attended with a feeling of more or less discomfort or pain. As the organic germ does, under circumstances favourable to its inherent developmental impulse, incorporate matter from without, exhibiting its gratification by its growth, and, under unfavourable conditions, does not assimilate, but manifests its suffering or passion by its decay; so likewise the ganglionic nerve-cells of the hemispheres attest by a pleasant emotion the furtherance of their development, and declare by a painful feeling of discomfort the restriction or injury which they suffer from an unfavourable stimulus.

It is the fundamental nature of organic element, whether of high or low degree, to feel as agreeable and therefore to ensue all which favours its preservation and increase; to feel as disagreeable, and therefore to eschew, all which hinders or prevents its activity and development. How indeed can that which is hurtful *agree* with it, and be therefore *agreeable?* Even in the earliest sensation, the existence of pain or pleasure is a sort of obscure judgment on its advantage or disadvantage to the personality or self—a judgment in which, as Herbart has remarked, the subject cannot yet be separated from the predicate that expresses praise or blame.[*] Among so many dangers, then, "to have a care of one's self is," in the words of Hobbes, "so far from being a matter scornfully to be looked at, that one has neither the power nor wish to have done otherwise. For every man is desirous of what is good for him, and shuns what is evil, but chiefly the chiefest of natural evils, which is death; and this he doth by a certain impulsion of nature, no less than that whereby a stone moves downwards." (2) And when he projects his imagination beyond the grave, it is by virtue of this same impulsion of nature operating in relation to the future that he aspires to attain the joys of heaven and hopes to elude the torments of hell. All the component parts of man, as well as the complex whole which they constitute, seek for a larger activity and increased vitality; whatever contributes to this increase is the proper good of each part; but it will be easily seen that the good of the whole, demanding the due subordination and co-ordination of parts, must often necessitate restraint on the undue development of the parts, just as the welfare of the social organism plainly demands the subordination of individual impulses. Children and savages best exhibit in a naked simplicity the different passions which result from the affection of self by what, when painful, is deemed an ill; when pleasurable, a good.

It is necessary to bear in mind that a stimulus which in moderation gives rise to a pleasant idea, or rather emotion, will, when too prolonged or too powerful, produce discomfort or pain, and consequent efforts to escape from it. There is then a *desire* to shun the stimulus, like as one altogether noxious is shunned; the desire becoming the *motive* or spring of action. The impulse in such case is described as desire, because there is consciousness of it; but it is without doubt the equivalent in a higher kind of tissue of that effort which the lowest animal organism exhibits, without consciousness, to get away from an injurious stimulus. In both instances there is, in truth, the display of the so-called self-conservative impulse which is immanent in all living matter—an impulse or instinct, which, whatever deeper facts of intimate composition may be connoted by it, is the essential condition of the continued existence of organic element. Such reaction of organic element is as natural and necessary as the reaction of any chemical compound, because as much the consequence of the properties of matter thus organically combined.

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[*] "Ein Urtheil, in dem nur das Vorgestellte sich noch nicht von dem Prädicate, das Beifall oder Tadel ausdrückt, sondern lässt."—HERBART.

When the stimulus to a hemispherical nerve-cell is not in sufficient force to satisfy the demands of the latter,—when, in fact, it is inadequate, then there is the manifestation of an affinity or attraction by the nervous centre, an outward impulse, appetence, or striving, which, again, as it occurs in consciousness, is revealed to us as *desire*, *craving*, *instinct*, or *appetite*. There is no difference, indeed, as Spinoza observes, between appetite and desire, except in so far as the latter implies consciousness; desire is self-conscious appetite. (3) Because we have an appetite or desire for something, therefore we judge it to be good: it certainly is not because a thing is judged to be good that we have an appetite or desire for it. Here, again, there is an exact correspondence with that attraction, impulse, or striving of organic element towards a favourable stimulus manifested throughout nature, the necessary correlate of which is a repulsion of what is unfavourable.

Because the affinity is exhibited in vital structure, we are prone, when observing it, to transfer our own states of consciousness to the organic element, and, therefore, to represent it on all occasions as *striving*, by means of a self-conservative impulse or instinct, for the stimulus favourable to its growth. But the attraction is no less a physical necessity than the attraction of an acid for an alkali, of the needle to the pole, or of positive for negative electricity; if there were no stimulus, there would be no reaction on the part of the organic element; if the stimulus were in injurious excess, or otherwise unfavourable, there must be disturbance of the statical equilibrium and a reaction of repulsion; and when the stimulus is favourable but deficient, the reaction is evinced in an attraction or affinity for an additional amount, like as when a non-neutralized acid takes up more alkali or as unsatisfied appetite craves more nutriment. Now, it is most important that we do not allow the presence of consciousness to mislead us as to what is the fundamental condition of things in the ganglionic cells of the brain. Here, as elsewhere, healthy organic element manifests its fundamental properties, pursuing the good, eschewing the ill; and consciousness is something superadded which nowise either occasions or abolishes them. The striving after a pleasing impression, or the effort to avoid a painful one, is at bottom a physical consequence of the nature of the ganglionic cell in its relation to a certain stimulus; and the reaction or desire becomes the motive of a general action on the part of the individual for the purpose of satisfying a want or of shunning an ill. The care of himself no man in good health has the power to neglect. To cease to strive is to begin to die, physically, morally, and intellectually.

It is plain then, not only how desires become the motives of action, but how they are gradually evolved into their complete form out of the unconscious organic appetites. The appetites for food and drink and the sexual appetite are the strongest motives of action, as they are the fundamental and urgent appetites of the organic being. In the desire of the adult there is necessarily some sort of *conception* of what is desired, though it is not a very definite one at times; but in the child, as in the idiot, we frequently witness a vague restlessness evincing an undefined want of, or desire for, something of which itself is unconscious, but which, when obtained, presently produces quiet and satisfaction: the organic life speaks out with an as yet inarticulate utterance. Most striking and instructive is that example of the evolution of organic life into consciousness which is observed at the time of puberty, when new organs come into action and exert their physiological influence upon the brain; vague and ill-understood desires give rise to obscure impulses that have no defined aim, and produce a restlessness which, when misapplied, is often mischievous: the amorous appetite thus first declares its existence. But to prove how clearly antecedent to individual experience it is, and how little it is indebted to the consciousness which is a natural subsequent development, it is only necessary to reflect that even in man the desire sometimes attains to a knowledge of its aim, and to a sort of satisfaction, in dreams before it does so in real life. The same thing is exemplified in a forcible and painful way by the lascivious features of certain forms of insanity in young women who, of perfectly chaste and modest life, then evince by speech, gesture and conduct a knowledge of means which it is impossible they could ever have acquired by observation or experience. The most chaste young man and maiden do not require to be taught how they shall gratify the passion which arises in their minds in consequence of the physiological changes which take place at a certain period of their growth. And yet if one were to consider the process of gratification as a thing happening for the first time, what an extraordinary and ludicrous thing it would appear that it should enter into the minds of two persons to make such use of their bodies in obedience to a blind desire.

These simple reflections might of themselves suffice to teach psychologists, if they would condescend to them, how far more fundamental than any conscious mental state is the unconscious mental or cerebral life. Given an ill-constituted or imperfectly-developed brain at the time when the sexual appetite makes its appearance, and what is the result? None other than that which happens with the lower animal, where love is naked lust, and the sight of the female excites a desire that immediately issues in uncontrollable efforts for its gratification. Given, on the other hand, a well-constituted and naturally-developed brain, the sexual desire undergoes a complex development in consciousness: its coarse energy undergoes refinement through the manifold interlacing plexuses of the ideational organisation, and from its basis are evolved all those delicate, exalted and beautiful feelings of love that constitute the store of the poet, and play so great a part in human happiness and in human sorrow. What, however, is true of these particular desires is true of all our desires: it may be fitly said, with Bacon, "that the mind in its own nature would be temperate and staid, if the affections, as winds, did not put it in tumult and perturbation;" or, with Novalis, that "life is a feverish activity excited by passion."

When the circumstances are exactly adapted to the capacity of the organic element, the stimulus exactly proportionate to the need, then are the conditions most favourable to the development of the latter; and a steady growth of it fails not to testify to the complete harmony of the relations. Or, adopting the language proper in such case to the highest relations of man, there is an equilibrium between the subjective and the objective, and no passion: there is satisfaction or indifference on the part of the *subject*, which has neither a painful feeling with consequent desire to avoid a suffering, nor a feeling of insufficient satisfaction with consequent desire to increase or continue an enjoyment. The conception of the qualities of the object is purer and clearer, and a steady assimilation, promoting the evolution of idea, goes favourably on. As there is no outward striving or craving in such case, the energy of the response to the stimulus is expended in the growth of the idea and in the reaction of it upon other ideas,—in other words, in intellectual development. Conception and desire, therefore, like perception and sensation, stand in a sort of opposition to one another, although in every mental act they co-exist in greater or less relative degree; in every conception there is, or has once been, as previously said, some *feeling*; and, again, in every distinct desire there is a *conception* of something desired. But the opposition between them is in reality a matter of the degree of formation of the idea or conception; for, whatever its nature, there is always more or less feeling with it when first experienced, which, however, disappears in proportion as it becomes definitely organised; and even though some little feeling or desire remains connected with the idea, it may often remain in consciousness, or only modify reflection, not being of sufficient degree to pass into outward manifestation.

May we not then justly affirm, as we clearly perceive, that the intellectual life does not supply the motive or impulse to action; that the understanding or reason is not the cause of our outward actions, but that the desires are? Our most effective energies spring from our most urgent needs. A strong desire or longing for a certain object in life often brings its own accomplishment. The desire is the fundamental expression of the individual's character, the manifestation of the essential affinities of his nature; accordingly he strives with all his might to attain unto the aim which he sets before himself, attracts to himself those influences which, coalescing with and strengthening his desire, augment its ascendency, and probably succeeds either in a direct or a circuitous way. Thus it is that aspirations are often prophecies, the harbingers of what a man shall be in a condition to perform. Men of great reasoning powers, on the other hand, are notoriously oftentimes incapacitated thereby from energetic action; they balance reasons so nicely that no one of them outweighs another, think so precisely over the event that they can come to no decision: with them, as with Hamlet, meditation paralyses action. From want of some cogent feeling impelling them to carry reflection into action, knowing what they ought to do they still do nothing; their judgment is in "the hapless plight of having no effective forces to execute its decrees." In fact, the power of the understanding is reflective and inhibitory, being exhibited rather in the hindrance of passion-prompted action, and in the guidance of our impulses, than in the instigation of conduct; its office in the individual as in the race is, as Comte systematically and emphatically pointed out, not to impart the habitual impulsion, but deliberative. (4)

As there are two factors which go to the production of an emotion—namely, the organic element and the external stimulus—it is plain that the character of the emotional result will not be determined by the nature of the stimulus only, but will depend greatly upon the condition of the organic element. The equilibrium between the individual and his surroundings may, in fact, be disturbed by a subjective modification, or an internal commotion, as well as by an unwonted impression from without. When some bodily derangement has affected the condition of the cells of the hemispherical ganglia, either directly or by a sympathetic action, then an idea arising is accompanied with certain emotional qualities, though it is an idea which, in health, is commonly indifferent; just as when a morbid state of an organ of sense, or of its sensory ganglion, renders painful an impression which in health would be indifferent or even agreeable. Every one's experience teaches how much his tone of mind varies according to his bodily states. The drunken man, at a certain stage of his degradation, becomes absurdly emotional; and the general paralytic, whose supreme nervous centres are visibly degenerate, is characterised by great emotional excitability, as well as by intellectual feebleness. The general feeling of well-being which is the result of a healthy condition of all the organs of the body and the expression of a complete harmony of functions is known as the *cœnæsthesis*, and is sometimes described as an emotion: but it is not a definite emotion, although it determines the emotional tone; it is the body's sensation or feeling of its well-being, and marks a condition of things, therefore, in which activity of any kind will be pleasurable—in which an idea that arises will be pleasantly emotional, not otherwise than as bodily movement is then pleasurable. On the other hand, the general feeling of discomfort which follows upon a visceral disturbance, or some other cause, is a condition in which activity of any kind will be rather painful than otherwise; there is a restricted or hindered personality, and an idea arising is apt to be gloomily emotional.

It plainly amounts to the same thing whether an excessive stimulus acts upon nerve-element when in a stable and healthy state and produces suffering, or whether a natural stimulus acts upon it when in an enfeebled or unstable condition and similarly gives rise to suffering: in both cases, there is, physically speaking, a disturbance of the equilibrium of the nervous element, or a resolution of it into lower but more stable compounds; or, psychologically speaking, there is, in both cases, an idea excited which is attended with painful emotional qualities—an idea unfavourable to individual expansion. The pain which is occasioned is the cry of organic element for deliverance. The greater the disturbance of nerve-element, however produced, the more unstable is its state; and an instability of it, signifying, as it does, a susceptibility to rapid molecular or chemical retrograde metamorphosis, furnishes the most favourable conditions for the production of emotion, passion, or *commotion*, as the term was of old. It is easy to perceive, then, how it is that great emotion, which is of the nature of a molecular explosion in the nerve-element, is exceedingly exhausting—for the same reason, in fact, that repeated electrical discharges by the gymnotus or torpedo produce exhaustion; it is easy to perceive, also, that whatever cause, moral or physical, works an exhausting or depressing effect upon an individual, inclines him to become emotional and to be distressed by ideas which trouble him not when he is strong.

The *original* nature of nerve-structure is, however, but one, though the main, element in the determination of the fundamental character of the emotions; we have to take account also of its *acquired* nature as this has been slowly organised by education, the relationships of life, occupations and pursuits, and a thousand accidental circumstances. Much discussion has taken place as to whether an emotion is merely a feeling of pleasure or pain accompanying a particular idea; whether, for example, benevolence is nothing more than the pleasant feeling that accompanies the idea of accomplishing the good of another, malice the feeling that attends the idea of injuring another, and so on. But there is some danger here of being confused or misled by words: it certainly must be allowed that there is something in the emotion more special than the general feeling either of pleasure or pain; such feeling is present, no doubt, but it does not determine the special character of the emotion; it is something superadded which determines only the agreeableness or disagreeableness of the emotion. It is, in reality, the specific character of the idea which determines the specific character of the emotion; and accordingly emotions are as many and various as ideas.(5) And it was before shown that the character of the idea is determined by the nature of the impression from without, and by the nature, as modified by a life experience, of the reacting nervous centre: this now containing an organisation of ideas as its acquired nature, or as the expression of its due development. But inasmuch as the individual inherits a certain temperament, which is the expression of the entire constitution of his body and displays its affective proclivities at the earliest period of life, the general lines of his ideational organisation are laid down for him in his nature: his conscious evolutions will follow the leading bents of his nature as they declare themselves in his fundamental feelings and desires, and he will grow into the maturity of that form of character which these radical tendencies promote.

How difficult it is to explain matters from a psychological point of view is easy to perceive; while we are considering the relation of emotion to idea, they are both concomitant effects of deeper lying causes. As there are subjective sensations, so also are there subjective emotional states. It depends upon the nature of the fundamental elements, the internal reacting centre and the external impression, whether in a given case we shall have a definite idea with little or no emotional quality, or whether we shall have the emotional quality so marked that the idea is almost lost in it. The hemispherical centres are confessedly not sensitive to *pain;* but they have a sensibility of their own to ideas, and the sensibility which thus declares the manner of their affection is what we call *emotional.* And as there may be a hyperæsthesia or an anæsthesia of sense, owing to the condition of the sensory centre, so also there may be a hyperæsthesia or an anæsthesia of ideas, owing to the conditions of the ideational centre. Certainly there do not appear to be satisfactory grounds either in psychology or physiology for supposing, as some writers do, the nervous centres of the emotions to be situated elsewhere than in the convolutions of the brain.

As we justly speak of the *tone* of the spinal cord, by the variations of which its functions are so much affected, so we may fairly also speak of a *mental* or *psychical tone*, the tone of the supreme nervous centres, the variations of which so greatly affect the character of the mental states that supervene. And as it appeared when treating of the spinal cord that, apart from its original nature and accidental causes of disturbance, the tone of it was determined by the totality of impressions made upon it, and of motor reactions thereto, which had been organised in its constitution as faculties; so with regard to the supreme centres of our mental life, from the residua of past thoughts, feelings, and actions, which have been organised as mental faculties, there results a certain psychical tone or character in each individual. This is the basis of the conception of the *ego*—the affections of which best reveal the real nature—a conception which, so far from being, as is sometimes said, fixed and unchanging, undergoes gradual change with the change of the individual's relations as life proceeds.* Whosoever candidly reflects upon the striking modification, or rather revolution, of the *ego* which happens at the time of puberty both in men and women, will surely not find it hard to conceive how the self may imperceptibly but surely change through life. The education and experience to which any one is subjected likewise modify, if less suddenly, not less certainly, the tone of his character. By constantly blaming some actions and praising others in their children, parents are able so to form their characters that, apart from any reflection, these shall ever in after life be attended with a certain pleasure; those, on the other hand, with a certain pain. Men become as automatic in their feelings as they notably are in their thoughts and actions; and they go on fostering these feelings by seeking those things which excite pleasant emotions and shunning those things which excite painful emotions. Moreover, the whole aim of the education which they give to their children is to make them think, feel, talk, and act just as they themselves do, to make them react in the same way to the same impressions; so that one generation of men is almost a repetition of the preceding one, and the marvel is, not that men follow in the footsteps of their forefathers, but that variations do take place, that an original man who is inspired to go out of the usual grooves of thought, feeling and action ever is produced among any people. Experience proves that the customs and religions of different nations differ most widely; what one nation views as crime another praises as virtue; what one nation applauds as a legitimate pleasure, another

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* "Thus you see that in the course of a long life a man may be several persons, so dissimilar that if you could find a real individual that should nearly exemplify the character in one of these stages, and another that should exemplify it in the next, and so on to the

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last, and then bring these several persons together into one company, which would thus be a representation of the successive stages of one man, they would feel themselves a most heterogeneous party, would oppose and probably despise one another, and soon separate, not caring if they were never to meet again." *Essays*, *John Foster*, p. 57, 27th Ed.

reprobates as a shameful vice: there is scarcely a single crime or vice that has not been exalted into a religious observance by one nation or other at one period or other of the world's history. The prayer of the Thug was a homicide, his sacrifice a corpse. How much, then, is the moral feeling or conscience dependent upon the due educational development of the mind! (6)

The manner in which music affects some persons, producing a lively feeling of immediate pleasure, calming mental agitation and exalting the mental tone, and thereby indirectly much affecting mental activity, affords an excellent example of a marked effect upon the psychical tone by physical agency; it might be adduced, if it were necessary, to attest the corporeal nature of the process. Such sentiments as the love of wife and the love of children, various as they are in kind and degree in different persons, are not so much definite emotions as a general tone of feeling resulting from certain relations in life; they represent a mental state in which ideas in harmony with the tone of mind will be attended with a pleasant emotion, and discordant ideas with a painful emotion, just as harmony in music produces pleasure and discord produces pain. So also of the refined feeling of social propriety, which is easily recognised in one who has it, and the absence of which cannot be concealed, is indeed made more evident, by the pretence of it; there is not a definite emotion, but a disposition or tone of mind with which certain thoughts, feelings and actions harmonize so as to occasion pleasure. The refreshing and invigorating influence of some powerful imaginative writers does not depend so much on the actual sense of the words as upon the tone of mind produced by them. Let a man read a chapter of Isaiah, and whatever opinion he may have of it from a purely intellectual point of view, he cannot fail, if he have any harmony of soul in him, to be stirred to a high emotional tone by its lofty strain of feeling and its grandeur of conception.

Again, the higher æsthetic feelings are without question the result of a good cultivation, conscious development having imperceptibly become a sort of instinctive endowment, a refinement to which vulgarity of any kind will be repugnant; they are the bloom of a high culture, and, like the cœnæsthesis, represent a general tone of mind which cannot be described as definite emotion, but in which certain ideas that arise will have pleasant emotional qualities. Moral feeling, however, furnishes the highest example of this acquisition of excellence of tone, by virtue of which certain actions instantly, without reflection, attract as virtuous, others are repelled as vicious. Reflect, again, on the powerful effects which the aspects of nature produce upon philosophic minds of the highest order: the vague mysterious feelings which such minds have, as instinctive expressions of their fellowship with nature, thrills of that deep harmonious sympathy with nature whereby they are transported with an indefinite feeling of joy in view of certain of her glories, or oppressed by a dim presentiment of evil under different relations—these are vague psychical feelings that in reality connote the highest intellectual acquisition; they are the consummate inflorescence of the highest psychical development, the supreme harmonies of the most exalted psychical tone. (7)

We must not lose sight of the fact that when we speak of the original nature of nerve-element we have by no means a simple factor to deal with; on the contrary, it is a very complex affair, and the study of its affections, if thorough, must go deeper than the individual and his consciousness. It admits of no doubt that capacities of emotion which are now innate in the individual have been acquired by the race. A well-born individual of the most cultivated nation in the most civilised age is capable of feeling emotions which it would be impossible to arouse in the mind of a low savage; and even were the two persons placed under the same external conditions from the moment of birth, the difference in this respect would undoubtedly still be vast. It is impossible to believe that any circumstances, though ever so carefully adapted, would produce in the savage, if placed under their fullest influence from his childhood, the refined and complex emotions of the highest civilisation. There is not a being born into the world who does not carry in his nature the cultivation of his epoch, marking, so to speak, its stage of humanization; even the idiot displays something of it in his wreck of mind; and in order to bring the low savage to the level of the cultivated European, it would be necessary to carry on a process of humanization, or, to coin a more special word for present use, a process of emotionalization, through many generations. It is in consequence of his natural inheritance that the civilised person may have vague emotions aroused in his mind before experience has given to them definite form, diffused indefinite feelings such as the savage cannot have, which fit him for subsequent special culture along definite emotional tracks. The so-called *preconscious* soul, of which some philosophers have written, is truly the preconscious mental life of the race, incorporated and awakening to consciousness in the latest embodiments of humanity. Whosoever then would make a complete analytical study of the emotions, must go backwards through the course of evolution of mankind, resolving into its simple elements much that now is a complex whole; must, as it were, fantastically imagine mankind to live back again to its earliest infancy, through all the scenes of its past history, and to give off from its mental acquisitions at each step, as it goes backwards, that which was gained when it was there in its progress; thus displaying the genesis of the emotions by stripping off one contribution after another, and laying bare the naked state of man at the beginning of the long train of mental modifications and acquisitions.*

This resolution or retrograde metamorphosis of the emotional nature is sometimes partially done for us by disease. At any rate this is the best explanation which I have to offer of the extraordinary precocity in cunning, lying, and vicious propensities which is displayed sometimes by certain very young children who, descended from families in which insanity or epilepsy prevails, are afflicted with a genuine moral insanity. They are destitute of all feelings of affection for father or mother, brother or sister; have no social sympathies, so that they mingle not with other children in their play and their pursuits; delight in destruction and in the infliction of cruel tortures on such animals as they dare meddle with; lie or steal with an ingenuity that is incredible to those who have not experience of their extreme moral perversion; and display sometimes a surprising precocity of sexual feelings and propensities. They are not in the least degree susceptible to moral influence, the severest penal discipline and the most patient forbearance alike utterly failing to work a reformation in their character. The fact is that they are destitute of that potentiality of moral development which should be innate in the human constitution at this age, in this respect being on a level with the monkey, which they resemble in their conduct; they are anti-social beings, bereft, through the tyranny of a bad organisation, of the moral element which is the latest acquisition of human evolution. But their nature contains implicitly, as by involution, all the lower elements of the human kind, all those which it shares with the monkey and other animals, and which it presumably displayed in unrestrained freedom in the premoral ages of its existence. Consequently, when such an insane being appears on the scene, we witness an instance of decomposition of the human kind; there is not only an individual, but there is human nature, in perverse action, in retrograde metamorphosis; wherefore are presented exhibitions of degenerate action which, so far as regards the individual child, seem to mark an inexplicable prematurity of vice.

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* Foster, in his *Essays*, makes this conception of the individual character.

Humanity is contained in the individual; whatever act of vice, folly, crime, or madness one man has perpetrated, each man has in him the potentiality of perpetrating; for which reason men read and do well to read regularly the ten commandments, and to pray that their hearts may be inclined to keep them. As in one word ages of human culture are summed up, so in one mortal are summed up generations of human existence: in his nature as in his knowledge man is the inheritor of the acquisitions of the past—the heir of all the ages. If we take the words which express the thoughts of a high mental culture, and trace their origin and the gradual development of their meanings, what a succession of human experiences, rising in complexity, is displayed! What a slow process of growth unfolds itself, answering to the slow gains of mankind, before the abstract word reached that speciality and complexity of evolution which it now marks! There is not an abstract term which does not mean generations of human culture. Let us take, in like manner, the human being, and trace back through the long records of ages the steps of his genesis, or examine rather the resolution of his essential human nature into its lower elements, as exhibited in the degenerate acts and tendencies of the insane child, and we shall cease to be surprised at phenomena which the young creature never could have acquired, and which, so far as its conscious life is concerned, appear strangely precocious and inexplicable. We are witnesses of a retrograde metamorphosis of humanity, of the undoing of what has been done through the ages, of the formless ruin of carefully fashioned form.

Besides the emotional nature of his kind at the particular grade of its development which a man has innate in him, he inherits also the more special emotional nature of his own immediate ancestors. His father and mother, his grandfather and grandmother, are latent or declare themselves in him; and it is on the lines thus laid in his nature that his development will proceed. It is not by virtue of education so much as by virtue of inheritance that he is brave or timid, generous or selfish, prudent or reckless, boastful or modest, quick or placid in temper; the ground-tone of his character is original in him, and it colours all the subsequently formed emotions and their sympathetic ideas. As the susceptibility of a particular sense may draw the individual to certain pursuits in life and so affect greatly the character of his intellectual development, so the predominance of a certain emotional tone will operate to determine an organization of sympathetic ideas. The influence of systematic culture upon any one is no doubt great, but that which determines the limit and even in some degree the nature of the effects of culture, that which forms the foundation upon which all the modifications of art must rest, is the inherited nature. Many an experience in life teaches the individual who has had the blessing of a good parentage how incalculable is his debt; when compelled to act at critical moments, or under difficult and trying circumstances to which he was not consciously equal, or under great temptation to wrong, or in any other case in which his art has failed him, he shall have had cause to bless the nature which he has inherited, to give thanks for the reserve force of a sound and vigorous character which his parents have endowed him with, and which has stood him in good stead and inspired him, as his leisurely consideration proves, to do rightly when he knew not what he was doing. The individual's nature is beneath his art: if sound, it will come to his rescue when culture fails him; if unsound, it will overthrow him in the hour of trial in spite of culture. Better than all that has been taught him by his pastors and masters, it will enable him to meet his last fate with becoming dignity in the hour of death and in the day of judgment.

Those who have had the most experience of men and affairs, and the insight to profit well by it, recognize the unfailing constancy of the manifestations of character; they reckon upon the acts and feelings of persons with whom they have to do, as they do upon the outcome of an arithmetical calculation or upon the effects of physical and chemical laws; looking to the tree for fruit after its kind, they cannot be persuaded that grapes will ever grow on thorns or figs on thistles. Common observation has always recognized, and has expressed in various popular sayings in all languages, the vital influence of breed upon character, and the impossibility of eradicating nature. It is more important to know what a man's father or mother was than what his schoolmaster was. If he has not got the basis of a strong character in the original constitutional structure of his mind, he will never acquire it; for if he has it not, how can he have sufficient force of *will* to make the complete experiment; and if he can exert the requisite will to use the means for its attainment, he already has the character.

In considering the complex nature of the emotions or affections of mind, it is necessary not only to take account of the inherited acquisitions of the race, of the more special inheritance from the immediate ancestors, and of the effects of education, but it is necessary also to take account of the effects which the different bodily organs exert upon the mental life. They are the foundations of the affective nature. As each sensory organ, or as each group of movements, has its representative centre in the grey matter of the cerebral convolutions, so there is reason to believe that each internal organ of the body has its representative centre in the supreme cerebral centres, through which it takes its essential part in the constitution and function of mind. The nature of our sensory perception of light, sound, taste, smell, is determined by the special organs of these senses, the same impression on the different organs, if capable of stimulating them, giving rise to their special sensations; in like manner, it may well be that other organs of the body have their specific effects upon mind, giving rise to specific emotions and their sympathetic ideas. They are plainly bound together in the closest union and sympathy, constituting a physiological commonwealth in which if one member suffer the other members suffer with it; for although they are insensible to touch when exposed, they have a sensibility of their own, different in kind from that of the skin, by virtue of which they agree in a consent of functions, and feel and sympathize with one another's affections. Now the brain is the leading member of this physiological union, the centre in which the different organic impressions meet and are co-ordinated; wherefore the supposition that it carries on this important function of organic life quite apart from and independently of its function as the organ of mind would be most improbable, even if observation did not contradict it.

As a matter of fact, observation does contradict it positively. We have the plainest instance of this in the case of the reproductive organs, the functional development of which, taking place somewhat abruptly at puberty, works a complete revolution in the mental character. The individual is transformed: his entire sentiency is changed, and he becomes susceptible to impressions which before were completely indifferent to him; a look, a tone, an odour, a touch arouses emotion that is quite new to him, and sympathetic ideas that come he knows not whence or how. Strange and vague feelings, aimless longings, obscure impulses, and novel ideas witness to the commotion which the newly-developed function is making by its irruption into the mental life: there is an "awakening of sensual impulses which clothe themselves in mental forms, of mental necessities which clothe themselves in sensual images." It is now, too, that altruistic feeling begins to germinate in the mind; before puberty a boy is the most complete egoist, taking as a matter of course all the affection and care which are lavished upon him; but, after puberty, he begins for the first time to have some sense of what others do for him, and to display some feeling of his obligation to them. If we were to go on to follow the development of the sexual instinct to its highest reach we should not fail to discover a great range of operation; for we might trace its influence in the highest feelings of mankind, social, moral, and religious. These evolutional effects of the functional development of the reproductive organs upon the mind do not take place when such development is prevented by their removal before puberty. The minds of eunuchs are mutilated like their bodies; they are said to be cowardly, envious, liars, utterly deceitful, destitute of social and moral feeling; with the deprivation of sexual feeling, they are deprived of all the mental growth and energy which it inspires directly or remotely. How much that is it would be hard to say; but were man deprived of the instinct of propagation, and of all that mentally springs from it, it is probable that most of the poetry,and perhaps all the moral feeling, would be cut out of his life.

We have not the same opportunity of observing the mental effects of other bodily organs which we have in the case of the reproductive organs, because they are in functional action directly we are born, or long before we are capable of any mental function, and we have no means of knowing what sort of mind we should have without them. But it may well be that the general uniformity of passions and desires among mankind is owing to the uniform operation of the bodily organs upon the brain, just as the general uniformity of their ideas is owing to the uniform action of the organs of the senses. Because all men have the same number and kind of senses, therefore they have the same kind of intellectual function; and, in like manner, we may suppose that they have the same kind of passions because they have the same number and kind of internal organs, each of which has its more or less specific operation upon the mind. To me it seems a scientific truth that there is nothing outwardly displayed in the bodily function which has not its internal representation in the central nervous system—which is not, so to speak, contained in the innermost—and I cannot doubt that the effect of each different organic structure with its corresponding function upon the brain is special; that the outer differentiations betoken corresponding inner differentiations. As the internal organs have not any direct communication with the environment of the organism, they would, had they not cortical representation in the cerebral hemispheres, be without any means of adjustment to its external relations either directly or indirectly, notwithstanding that such adjustment, in a direct or indirect way, is a characteristic of life in all its forms; but having, as I believe, their cerebral representation, they exert thereby such effect upon the so-called animal life or the life of relation of the whole organism as is fitting for them as co-ordinated parts of a complex whole. And that is no small effect; for it is from the affections of mind that the impulses to action spring—from the organic life, therefore, that the motor force of the body is fundamentally derived.

It need not be supposed that each organ is the direct cause of a special passion or desire—that tenderness lies in the heart, anger in the liver, envy in the spleen, as old writers believed; it is sufficient to assume that each organ sends its unfelt contribution to the systemic consciousness or cœnæsthesis, and modifies it accordingly. The consciousness of the moment may be conceived to be the complex product of an infinite multitude of simple and compound vibrations coming from the external and internal organs of the body. And just as the condition of the reproductive organs produces a certain tone of the nervous system which renders it susceptible to special impressions, and promotes the occurrence of special ideas and feelings, so may the condition of a particular organ so modify the tone of the nervous system as to render it susceptible to particular impressions, and to favour the occurrence of certain feelings and their sympathetic ideas; the differentiated cerebral centre of the organ being in close relations with certain ideational tracts. This is one reason why psychologists have not succeeded in analyzing the emotions as they have in analyzing some of our apparently simple intellectual ideas — why they have not yet decomposed them into their elements, as they have decomposed our ideas of figure, size, position, distance. They are able to study the separate action of each of the several senses in the building up of an idea, but they are not able to isolate the separate action of each of the internal organs of the body, and to estimate its particular function in the composition of an emotion. The method of psychology is entirely at fault here, for self-consciousness yields no help towards a discovery of the connection between the emotional state and the bodily organ.

The most hopeful method to pursue in this case would be to observe patiently and carefully the mental symptoms of diseases of the different organs, so far as there are any, and the effects of their disorders upon dreams. The emotional or affective features of disease of the heart, disease of the lungs, disease of the liver, are unquestionably very different in some cases; and although it may be argued that the effect in each case is due not to the direct nervous sympathies of the organ, but to an indirect effect upon the nervous system through the changes which the deranged organ produces in the composition or circulation of the blood, I doubt greatly whether the explanation will be found sufficient to cover the phenomena. The suggested inquiry is, without doubt, a very difficult one, but it is probable that a careful observation and record of the curious features of dreams might yield valuable help. No one will dispute that we dream different dreams according to our different bodily states; the ground-tone of feeling being sometimes manifestly determined by the state of an internal organ, the irritation of which stimulates that part of the brain with which it is presumably in specific sympathy. Ideas that are associated with the particular feeling, the tracts of them being presumably in special relations with its centre, thereupon become active and combine in a more or less coherent dream-drama. When the avenues of impression upon the brain through the external senses are closed by sleep, and the consciousness of the outer world is in abeyance, there may well be a greater susceptibility to impressions from within the body, and so the physiological sympathies of organs may declare themselves more distinctly, just as the stars, invisible in the day, shine forth brightly at night when the sun goes down. These organic sympathies which are the conditions of affective function are not completely intermittent like sensory and motor functions; they cease not entirely day or night until the sun of life sets for ever in death. "We tire of thinking and acting," says Comte; "we never tire of loving."

If it be thought that I lay too great stress upon the influence of bodily organs upon mental states, and that it is impossible we should owe so much to them without being more conscious than we are of their operations, let it be considered how much we owe to our muscular sense without being ever conscious of its action until we are deprived of it. When the muscular sense of a limb is paralyzed, the motor power being unaffected, as happens in one form of disease, the person cannot regulate its movements and use it unless he makes use of the sense of sight to inform him of his condition: when the arm is thus affected he cannot grasp an object unless he looks at it, and if he has laid hold of it he instantly lets it drop when he turns his eyes away; if his legs are affected, he cannot stand but totters and falls down when he shuts his eyes. He walks, sits, stands, moves, performs all acts of his life by virtue of essential information which he is constantly receiving through a thousand channels from every part of his body without ever knowing from consciousness that he is receiving it. In like manner our mental functions may habitually receive specific contributions from specific organs without being directly conscious of them, because they have been constantly poured in from the first moment of life and enter radically into the constitution of the *ego*. It is probable that much of the mental characters of diseases may be due to modifications of this kind of influence. Mind represents a general consensus between affective, ideational and active functions, all of which co-operate but one or other of which may predominate on a particular occasion.

It is easy to distinguish two different classes of mind among mankind,—a subjective class marked by the tendency to feel intensely rather than to see clearly, or at any rate to mix feelings in observation and reasoning, more often met with amongst women than men; and an objective class, more able to look at things in the dry light of reason. It might fairly be argued that these different views of things are due to the relative predominance in consciousness of internal and external impressions, emotional persons having susceptible internal organs. Women at any rate appear to owe the self-feeling which shows itself in quick and mobile emotional susceptibility, in great part, to the cerebral sympathies of their reproductive organs; and certainly the person who has fostered self-feeling until it has swallowed up all other kind of feeling is the hypochondriac who has cultivated his organic sensibilities into conscious feelings. He is like a person who by careful attention can become sensible, in listening to a simple musical note, of the separate harmonic overtones which constitute its quality, and which most persons never perceive.

It is probable that many vague feelings or indefinite emotional states to which we have no adequate or corresponding ideas are produced by the operations of the internal organs; they are of a very vague character, and cannot be expressed in definite objective signs, wherefore they cannot become knowledge. We have the best instances of what I mean in the vague overmastering feelings to which pregnancy and the development of puberty give rise; and it is certain we must go deeper than self-conscious analysis will ever get, to arrive at their true nature and causation. Even the passion of love itself has its source in the unconscious life, and can no more be explained in consciousness than the feelings of hunger and thirst; it marks an elective affinity of the organism which oftentimes enslaves consciousness and overpowers volition. The weaker the conscious factors in mental function, the more power have the unconscious factors, as we plainly see by the examples of women and of children, of persons labouring under sickness, and of those who are dying.

There is yet another cause of affection of the emotional tone which it is necessary to mention, namely, the condition of the blood supplied to the nervous system. When its composition is altered, either by matter bred in it, or introduced into it, its influence on the feelings is most marked. Illustrations of this action being familiar to everybody, it will be sufficient here to call to mind the influence of alcohol upon the mind, and to instance the effect which Indian hemp or haschisch produces when it is eaten. It occasions, according to Moreau, a vague, happy, emotional expansion, not sensual but spiritual as to form, and not unlike that which is produced in one who has heard good news, or has met with a great success; he compares it also to the indefinite and tender emotional feeling which is awakened at the epoch of puberty. There is no sensual excitement if there be no sensual provocation; if, however, the sensual organs are excited by some means, the feeling ceases to be vague and purely ideal, and takes definite form and aim. In the East, therefore, it is said that the haschisch is often mixed with substances having aphrodisiac properties, in order to excite passion and to give the desiderated sensual colour and form to the dream-delirium. When the emotional tone is thus affected by a foreign substance introduced into the blood, we cannot doubt that some physical or chemical effect is produced in the nerve-element, which is the condition of the changed function; in fact, as strychnia acting upon the motor nerve-centres so affects their composition that they explode in convulsions, so there are substances which acting upon the higher nerve-centres so affect their constitution or composition that they discharge their energy in molecular explosions of emotion.

When an emotion is excited its tendency is to discharge itself externally by certain motor channels or upon the internal organs of the body. In children and savages simple emotions are easily excited, and rapidly discharged in movements. A young child, if delighted, laughs with voice, face, limbs and body; when in a violent rage it rolls on the ground, screaming, kicking, scratching and biting. In the idiot an explosion of passion is sometimes an explosion of convulsions. But in educated persons, with whom the aim of culture is to prevent the explosive display of emotion, the muscular expressions thereof are more limited, being confined chiefly to the nose and mouth—to the orbicular muscles of the lips with the system of elevating and depressing muscles. Still, when an emotion is violent it escapes from control, overflows its ordinary channels, and pours into neighbouring motor channels: laughter spreads from the mouth to the muscles of respiration, and from them perhaps to the arms and legs; and terror may produce, in addition to its usual facial expression, short, quick and impeded breathing, gasping, and tremulous motion of the lips, convulsive action of the muscles of the neck and shoulder—the extraordinary muscles of respiration—and tumultuous beating of the heart. When a person is undergoing a gradual suffocation by prevention of access of sufficient air to the lungs, he makes what are called frantic efforts at inspiration, bringing into action all the extraordinary or supplementary muscles of respiration; and he displays the same violent motor phenomena when he is in a state of frantic terror.

It was long ago pointed out by Unzer that the motor expressions of the emotions are really the movements which would be manifested in greater degree if the emotions and desires were realized in action, the same mechanical external machines being put into incomplete action, and the emotions being a nascent excitation of the mental states which would accompany the acts. For instance, in the appetite for food, the gratification of which is the taking of food, saliva is poured into the mouth just as when food is taken; in the desire to give suck, the satisfaction of which is the relief of the breasts by the discharge of the milk from the nipples during suckling, the nipples become erect and there is a flow of milk to them. In the desire for revenge, the gratification of which is to injure the offender, the natural weapons of offence are put in action, animals ejecting their poison, thrusting out their stings, attempting to tear, bite, or kick, and man clenching his fist, stamping his feet, and gnashing his teeth, as he would do if he were actually taking his revenge. In terror, the satisfaction of which is the averting of a great impending danger, the struggles for preservation are seen in the starting back, the shrinking, the sudden standing still, and the open mouth by which a deep inspiration is taken in order to prepare for exertion. In shame, the satisfaction of which is the avoidance of the glance of the person whose contempt is feared, the eyelids are dropped in order to withdraw oneself as much as possible from the glance. The foreseeing of a fall from a height excites us involuntarily to hold fast as we should do if we were actually falling.* Mr. Darwin has pointed out that in a large number of animals, belonging to widely-different classes, an erection of the hair or feathers takes place under the influence of anger, whereby the animal appears larger and more terrible to its enemies or rivals, and that the erection is almost always accompanied by threatening gestures—opening of the mouth, uncovering of the teeth, spreading out of the wings and tails by birds, and by the utterance of harsh sounds. In those animals which fight with their teeth, a savage frame of mind is shown by the drawing back of the ears, which are pressed close to the head, this being the position given to them when the animals actually fight, in order to prevent them from being seized by their antagonists. The retraction of the lips and the uncovering of the teeth in man during rage is probably a remnant or survival of a habit acquired during primeval times when his semi-human ancestors fought with their teeth.*

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* Unzer and Prochaska, *On the Functions of the Nervous System*, p. 129. *Syd. Soc. Transl.*

We often use the same word to describe the quality of an emotion which we use to describe the quality of a a sensation; speaking, for example, of piercing sorrow, of soured feeling, of corroding grief, of revenge, "sweet at first, but bitter ere long," just as we speak of a sour, bitter, or sweet taste; in like manner we use the same movement to express an emotion which we use to prevent, lessen, or increase a sensation. It would perhaps be as true of emotion as of intellect to say that there is nothing in the emotion which was not previously in sense. The face of a person eagerly pursuing a thought is that of one trying eagerly to see something which is difficult to be seen, pursuing it, as it were, with his eye; the expression of one who understands not a proposition made is like that of a deaf man who hears not but tries to hear what is said; the expression of one who expects an unwelcome announcement to be made is that of one who shrinks from a loud sound, as of a gun about to be fired; the expression of sneering seems very much that of excluding an unpleasant smell from the nostrils, if it be not, as is perhaps more likely, a partial snarl; the expression of disgust, that of ejecting from the mouth and nostrils something offensive; the attitude of one who repels a repugnant suggestion is that of nascent bodily resistance; the attitude of mental aversion, that of turning away bodily from a disagreeable object; the attitude of defiance, that of one who stands four square to all the winds that blow; and the attitude of humility is just the opposite. Thus it appears that emotional movements are radically determined by, if they are not more or less complete reproductions of, such movements as have been produced by affections of the senses, or have been performed for some definite end under the influence of the same emotions: they are survivals of past adjustments to the social environment.

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* Darwin. *The Expression of the Emotions.*

It is because emotions have their definite expressional movements that there is an art of discovering the predominant mental characteristics of men in the lineaments of the face. By frequent repetition of the movements of predominant or habitual desires or emotions, these mould the character of the features; whence it happens that we observe sometimes a positive assimilation of features from similar pursuits, habits and sentiments, as, for example, in the acquired resemblance which has been observed to be brought about between man and wife. The attempt to repress the natural expression of a predominant emotion, as when a person bites or compresses his lips in order to prevent his anger finding vent in speech, act, or features, necessitates a muscular action of constraint which, though it hides the natural language of the emotion, is sufficiently significant to those who can interpret the more complex and artificial physiognomical signs. Animals have their leading instincts and passions, in the gratification of which they find their greatest pleasure; the features and figures being moulded to perform the movements which gratify these leading desires do more or less plainly disclose their nature. The feline structure, with its lithe movements, retractile claws, and soft and treacherous tread, declares the feline nature. Those who make a study of human faces cannot fail to detect often in them resemblances to animal physiognomies: one face will call to mind the fox, another the tiger, a third the lion, a fourth the elephant; and any one who makes a study of these resemblances will be surprised to find how closely these animal-like peculiarities of features are often accompanied with corresponding mental characters. Within the human there is an animal nature, a brute brain within the man's, and in some persons the features plainly betray the nature of the special animal.

It must be confessed that the discovery of the mind's construction in the face is a matter of individual skill, and not one which can be taught; it is an art the principles of which it has not yet been possible to formulate; but there can be no doubt of the extraordinary skill which some persons acquire, or of the value of the information which those who have the requisite acuteness and experience may obtain thereby. For, as Bacon said, "the lineaments of the body do disclose the disposition and inclination of the mind in general; but the motions of the countenance and parts do not only so, but do farther disclose the present humour and state of the mind or will. And therefore a number of subtle persons whose eyes do dwell upon the faces and fashions of men, do well know the advantage of this observation, as being most part of their ability; neither can it be denied but that it is a great discovery of dissimulation and a great direction in business."

Mr. Darwin has formularized three principles which appear to him to account for most of the expressions and gestures involuntarily used by man and the lower animals under the influence of emotions. The first is the principle of associated serviceable habits. Certain complex actions are directly or indirectly useful in relieving or gratifying certain sensations, desires, &c.; and whenever the same state of mind is induced, however feebly, there a tendency through the force of habit and association for the same movements to be performed, though they may not then be of the least use. Some of these movements may be partially repressed by the will, and the muscles which are least under the control of the will are then most liable to act, the movements caused by them being recognised as expressive. In other cases the repression of one movement may necessitate other muscular contractions which, when their aim is recognised, will likewise be expressive. The second principle he calls *the principle of antithesis*. When there is produced a directly opposite state of mind to that expressed by certain habitual movements which were once or are still serviceable, there is a strong and involuntary tendency to the performance of movements of a directly opposite nature, though these may not be of the least use. Such movements are in some cases highly expressive. The third principle is the so-called direct action of the nervous system. When the sensorium is strongly excited, nerve-force is generated in excess, and must be discharged, the channels of discharge being determined by the connection of the nerve-cells and nerve-fibres, and partly only by habit. The effects thus produced are recognised often as expressive. It is natural to suppose that when there is a large generation of nerve-force in one centre, the excess of that which can readily be discharged by the nerve-fibres connected therewith will overflow, pass to neighbouring interconnected nerve-centres, and be discharged in molecular movements along the nerve-fibres proceeding from them.

But emotions have other channels of discharge besides muscular movements. They may be expended in action upon the secretions, or in nutritive changes, or in action upon the ideational centres. When emotional excitement is not discharged by motor channels it is apt to affect the internal viscera; it produces a disturbance or *un*ease of them, which may increase in degree to *dis*-ease; the principal channel through which this takes place being the complex vagus nerve, which regulates the force and rapidity of the heart's beats and the frequency of respirations, and influences to a great extent the secretions and movements of the stomach and intestines. It is through it that grief strikes the heart, getting its name of heartrending, and through it that terror affects violently the movements of the heart and of respiration; through it that the bated breath of suspense, the nausea of disgust, and the impaired digestion of sorrow are produced; and through it that the bowels yearn in sympathy. A strong emotion, like an electric shock through the vagus, may cause sudden death by paralyzing the heart, just as it may cause paralysis or convulsions of voluntary muscles.

Emotion will often increase, lessen, or alter a secretion, bidding the tears flow, perverting the bile, making the tongue cleave to the roof of the mouth; and it may be questioned whether there is a single act of nutrition which emotion may not affect, inspiring it with energy or infecting it with feebleness, according to its pleasant or painful nature, and so aiding or hindering recovery from disease. It is certain that joy or hope exerts an animating effect upon the bodily life, quiet and equable when moderate, but, when stronger, evinced in the brilliancy of the eye, in the quickened pulse and breathing, in an inclination to laugh and sing; grief or other depressing passion has an opposite effect, relaxing the arteries, enfeebling the heart, making the eye dull, impeding digestion, and producing an inclination to sigh or weep. Herein we perceive a sufficient reason of the disease in an organ which is sometimes the result of a prolonged depressing passion, especially of depression in its highest degree—hopelessness. And because the weak organ is ever the sufferer, because here, as elsewhere, to be weak is to be miserable, the effect of a passion is generally felt in the affected organ by one who is the subject of any local idiosyncracy; it sympathises more easily and more acutely with the centric commotion; wherefore one who has a weak organ should refrain from passion, if he would live long. Passion, in its essential nature, betokens the sympathy of the whole nervous system of the organic and animal life; and a great disposition to passion means a great susceptibility to such sympathy. Some of the terms which are used to describe emotional states, such as splenetic, melancholy, cordial, and such figurative expressions as pallid fear, pining love, envy wan, faded care, livid horror, green-eyed jealousy, grim-visaged despair, and the like, testify by their origin to a general recognition of the influence of the emotions upon the bodily functions; and it is for science now to trace out and classify the exact sequences of phenomena which have long been familiar in household words.*

It is a matter of common observation that an emotion may be diverted from one into another of its channels of expression. A person who is grossly insulted may vent his anger either in the quick movements of a retaliating blow, or in useless tears and lamentations, or in the ideational activity of devising plans of future revenge or of calling up Christian ideas of forgiveness or philosophical ideas of indifference. If the emotion be not discharged in outward bodily activity or in suitable inward mental action, it will act upon the internal viscera and derange their functions; sorrow is soon discharged by passionate wailing and weeping; it is the grief which does not speak that whispers the overfraught heart and bids it break. But it is not a good use to make of emotional energy to allow it to go to waste by discharging itself outwardly in useless wailing, or to do harm by discharging itself inwardly in derangement of the organic functions; it should be the aim of mental culture to retain it within the sphere of the intellectual life, and so to get the benefit of it in the supply of the interest and energy required for effective volition. A wise man soon perceives that he owes more in self-culture and worldly success to the disappointments and griefs which he has suffered than to the triumphs and joys which he has had.

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* Nearly all these figurative expressions are made use of in a few lines by Gray, who was skilful and industrious in culling apt phrases from the works of his predecessors, in his *Ode on a Distant View of Eton College.*

There is another consideration to be taken into account with regard to our emotions. When we fix the countenance in the expression, or the body in the attitude, which any passion naturally occasions, it is certain that we acquire in some degree that passion; and if we try, while the features are fixed in the pattern of one emotion, to call up in the mind a quite different one, we shall find it impossible to do so. There is an obvious fallacy in making the experiment, as in order to produce the suitable movements of expression we are compelled to imagine the passion; but after allowance has been made for this cause of error, there remains sufficient reason to believe that the emotion is intensified and made definite by the bodily action. In fact, as we complete our intellectual activity by the participation of the sensory centres, thereby rendering our abstract ideas definite through a sensory representation of them; or rather as our reasoning powers are developed by embodiment of thoughts in words through the instrumentality of speech; so in our emotional life any particular passion is rendered stronger and more distinct by the existence of those bodily states which it naturally produces, and which in turn, when otherwise produced, tend to engender it. There can be little doubt that each passion which is special in kind has its special bodily expression; this being truly an essential part of it. Mr. Braid found, by experiment on patients whom he had put in that state of artificial somnambulism which he described as *hypnotism*, that by inducing attitudes of body natural to certain passions he could excite those passions. If the spine and legs were straightened and the head thrown slightly back, the countenance assumed an expression of lofty pride; if the limbs and body were slightly flexed and the head bent forward, a feeling of great humility took its place; if the fist were doubled and the arm raised, the idea of fighting was excited; if the person were put on his knees, and his hands clasped, his countenance and actions bespoke profound devotion.

We perceive, then, how close is the sympathy or connection between the bodily system and the emotional or affective life which supplies the habitual impulsion to action; while the intellectual life which, as deliberative or regulative, controls and directs the activity of the individual, has the closest relations with the senses. From want of attention to the essential intervention of the whole of the bodily in the mental life—a neglect springing from the unjustifiable contempt of the body inherited from the theologists—the physical expressions of our mental states have not been studied with the care and industry which their significance deserves. As the Indian savage surely tracks the footsteps of his enemy where the untrained eye can see no trace; or as the American hunter, by careful observation of the appearances of the trees, guides himself safely through pathless forests in which the greatest philosopher would lose his way and perish; so it is probable that any competent observer who devoted himself to study scientifically, with close and patient attention, the manners of a large number of persons, and the different expressions of their features, their gestures, and their actions, might discover a certain clue to their character, and be able to read off with ease their feelings and desires. Our attention is distracted by the number of our senses, so that no one of them receives half the development of which it is capable.

It was the recognition of the intimate connexion and mutual reaction between the passions and the bodily life that moved Bichat to locate them, as the ancients did and in common language is now sometimes done, in the organs of the organic life. But although there was in this view the just acknowledgment of a truth, it was only of part of a truth; for, in the first place, not the organs of the organic life only, but those of the animal life also, are concerned in the expression and production of passion; and, in the second place, the feeling of the passion unquestionably takes place in the brain. It is the display of its organic sympathies. Consequently it is found that, as the effect of a depressing passion is felt by the victim of a local idiosyncrasy in his weak organ, so inversely the effect of a weak or diseased organ is felt in the brain by an irritability or disposition to passion, a disturbance of the psychical tone—in fact, by a state of unease, which may become a state of disease, of mind, if it go far enough. The phenomena of insanity furnish the best illustrations of this sympathetic interaction.

The study of disordered emotions will naturally find a place afterwards, when I come to treat of the pathology of mind. Suffice it here to say that disordered emotion may act upon the animal life, the organic life, and the intellectual life. It may grave itself in the lineaments of the countenance, or declare itself in the habit of the body; it may initiate or aggravate organic disease, producing, according to its duration, a transient or lasting derangement; and it may temporarily obscure, or permanently vitiate, the intelligence. When the emotions are disordered, as they are particularly in some forms of insanity, and generally at the commencement of insanity, pleasure is felt from objects and events which should naturally excite pain, and pain from causes which should naturally occasion pleasure in a healthy mind: scenes of disorder, excess and violence are grateful to the perverted feelings; order and moderation are irritating and repugnant. Instead of feeling and responding to those relations in the social environment which would promote his well-being and development, as in health he does, the degenerate individual exhibits an affinity for those relations which are hostile to his well-being, increase his degeneration, and tend to bring about his extinction.

It may be thought, perhaps, that it would not be amiss if something were now said of the difference between passion and emotion, inasmuch as the terms have hitherto been used almost indifferently. This, however, is scarcely necessary in dealing only with their general nature, which is fundamentally the same; every so-called emotion, when carried to a certain pitch, becomes a veritable passion. If it were thought well to distinguish them in a special analysis of the particular emotions, as it doubtless would be, the ground of distinction would be in the *egoistic* or *altruistic* character of them—names by which Comte distinguished respectively those feelings which have entire reference to self and those which have reference to the good of others. The passions, in fact, lie much nearer to the fundamental instincts or desires than do the emotions; the instinct or sensational impulse to which has been added a consciousness of its aim and of the means of its gratification becoming a passion.

Spinoza, whose admirable account of the passions will not easily be surpassed, only recognises three primitive passions, on the basis of which all others are founded—joy, sorrow, and desire. (*a*) Desire, he says, is the very nature or essence of the individual, whence it is that the joy or sorrow of each individual differs from that of another as the nature or essence of one differs from that of another. (*b*) Joy is the passage from a less degree of perfection to a greater degree of perfection, and accompanies, therefore, all actions that are called *good*. (*c*) Sorrow is the passage from a greater degree of perfection to a less degree of perfection, and accompanies all acts that are called *evil*. However, we perceive now, by the light of knowledge acquired since Spinoza's time, that he has not carried his analysis down to the physiological foundations of the passions.

From what has gone before, it will plainly appear impossible to deal satisfactorily with the emotions by considering them only as accomplished facts, and grouping them according to their characters as we observe them in an adult person of ordinary cultivation. The psychological method fails us entirely, as we are driven by it to study emotion under hopeless disadvantage; we are constrained to examine the complexity of an advanced development instead of following up, as is the true method, the genesis of emotion or the plan of its development. In the classification of the animal kingdom, the study of its plan of development is now acknowledged to be the only valid method of determining the true relations between one animal and another: in like manner the interpretation of the phenomena of mind cannot be rightly grounded except on an analysis of their development. Whosoever aspires to give an adequate account of the emotions should devote himself, then, to a laborious investigation of their simplest manifestations in the higher members of the animal kingdom; to the study of the different grades of their evolution in the savage and the civilized person, in the child and the adult, the woman and the man, the idiot and him who is in his right mind; and to the patient observation of their bodily conditions, and the careful delineation of their special bodily expressions. He must patiently unfold that progressive specialization and increasing complexity which prevail here as in every other department of organic development.

Like as simple ideas are blended or coalesce into duplex and complex ideas, and are connected in groups and series so that, by complex development, a character is formed, so are the *feelings* belonging to the ideas, and the *desires* accompanying them, blended and grouped in a corresponding complexity, and inclinations or disinclinations of every variety and complexity are thus formed as a part of the character. Again, the desire naturally attaching to a certain aim is often transferred after a time to the means by which that aim is attained, so that there ensue in this way manifold secondary formations: the end of wealth is to give enjoyment and comfort, but how often does a passion for the means oversway the end! By looking to a desirable end, an act naturally very distasteful, but which is necessary as means, may, by habituation, be rendered indifferent or even pleasing; and some consummate scoundrels are thus gradually fashioned, themselves unaware of the grievous issue in which many slight effects have insensibly culminated.* Falsehood is sometimes the shortest and easiest way of attaining an end, but the falsehood which succeeds avenges itself inevitably in the deterioration of character which it initiates or marks; the individual who habitually practises it comes to love it for its own sake, not as a means but as an end; false to others, he is false to himself in discernment, and is a known liar before he ever suspects that he is thought so.

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* *Nemo repente fuit turpissimus* is really the expression of the physical nature of the growth of character.

"Custom . . . .
. . . .
Constrains e'en stubborn Nature to obey;
Whom dispossessing oft, he doth essay
To govern in her right; and with a pace
So soft and gentle does he win his way,
That she unawares is caught in his embrace,
And tho' deflowered and thralled nought feels her foul disgrace."

Stanza of Gilbert West, quoted by Coleridge in his *Biographia Literaria*.

To make a profound study of the emotions one ought to go very far back and begin with the fundamental instincts or desires—certainly as far back as that of self-preservation with the emotions of self-defence which it entails, and that of propagation with the love of offspring which is so nearly connected with it, and endeavour to follow them from their most simple manifestations through their most complex evolutions. Of their origin we can give no further account than that they are properties of organic being; their ends, and the means to their ends, are not taught by experience, but are pre-existent in their nature; they witness to a pre-ordained reciprocal adaptation between organic being and the nature around it whence it is derived and to which it returns. Man cannot help feeling dimly through these instincts of self in their relations to the not-self that there is something beyond him, which was before he is and will continue after he no longer is, of which his being is but a passing phase; something, therefore, in him, as a transitory show of nature inspired by these instincts, of which no interrogation of self-consciousness will ever suffice to give an adequate account; something "which cometh from afar." Hence the strange glamour surrounding the overmastering passion of love; it is the mysterious instinct of universal nature thrilling through his nature, and is truly an enchantment; the individual is possessed by it, being transported out of the prosaic region of facts into a sort of ecstasy. It is nature's way of inveigling man into the propagation of his kind, however little wisdom he may see in continuing the tale of human misery upon earth. Hence also the expansive ardour which inspires youth with faith and enthusiasm that are sadly sobered by age. I know not whether the instinct of propagation ought not to be considered as in some sort a secondary display of the self-conservative instinct, for it is certain that people proceed to indulge it as a pure self-gratification, not with any design of begetting heirs of immortality. When an organic being has reached its fulness of life, and assimilation exceeds expenditure, it gives off in an act of sensual gratification a part of itself endowed with the same self-conservative instinct, and so strives by propagating itself through time to cheat death.

The intrinsic sense of or longing for the sustenance of life, which is translated into the belief of immortality, seems to me to be an evolution of the instinct of propagation in consciousness, and to spring fundamentally from the self-conservative impulse. Certainly the love of life and the fear of death are manifestations of the self-conservative instinct in consciousness. Hope and fear may be called expectant ideas, that is, ideas having reference to the future, into which a large emotional element enters, based, in the former, upon a desire for that which promotes the well-being, or fundamentally the life, and increases the power, of self, and, in the latter, upon a desire to escape that which is hurtful to self, threatening its well-being or life, lessening its power, and so taking part with death. Now hope acts like joy on the organic structures, producing the same animating effects in less degree; fear, on the other hand, produces in the organic structures the same destructive changes, in a nascent form, as would be produced by actual experience of the danger feared; threatening the organic life, the organs of which minister to the self-preservation, and by their sympathetic communion with the brain—their intimate physiological consensus with it—occasion the instinct. Joy and life go hand-in-hand on the upward path, as pain and death go together on the downward path. Therefore, if Heaven and Hell were inventions, they would still have been good inventions, as taking advantage of the fundamental instincts of being to attract it to the narrow path of development, and to avert it from the broad path of degeneration. Here, again, we are brought back to the instinct of self-preservation which runs through all the special and complex evolutions of our hopes and fears. Note in this relation how the word apprehend, which originally meant to lay hold of, and afterwards to grasp mentally, has now come to mean an expectant idea with fear—an apprehension.

Continuing to trace the evolution of the instincts in the mental life, we might go on to point out how fear first invented the gods, the unknown powers that inflicted sufferings the causes of which were beyond human ken, whom it was necessary to propitiate in a spirit of abject humility by prayers and sacrifices. From the instinct of self-preservation, translated into consciousness, springs the instinctive passion of self-defence by means of the natural weapons, mental and bodily, and, as secondary conceptions and desires, rage, malignity, and the desire of revenge by the most skilful use of the means that can be brought into play are connected with it. From the sexual instinct springs not only the complex emotion of love, as already mentioned, but jealousy, and we observe a further development of it in the love of offspring which is so strongly displayed in the blind brooding of animals. As in the progress of organic evolution from animal to man there has been an ascent from the sensuous to the intellectual, so in the sphere of the affective life there has been a progress from the propensities to the sentiments—from the individual to the social unit. The instincts accordingly have their related conceptions and feelings which, having been originally evolved from them, revolve, as it were, round them, and are directed to the attainment of their aim; so that the bias of a man's nature is determined by his instincts, and he has a tendency, however many and moral his higher conceptions, to lean to their side.

The highest emotional feeling to which mankind has yet attained is the moral feeling or sense, and science is now going about to trace it as an acquisition by the race. The old question of the origin of evil, on the discussion of which metaphysicians spent so much fruitless labour, was not the right question after all; the right question for discussion is the origin of good. Not how evil but how good was acquired is the problem to be solved. The internal organic adaptations which have taken place in correspondence with the external conditions of social existence have been propagated through generations, and that which was a gradual acquisition by the ancestors has become more or less an innate endowment of the offspring. In this way, which is, so far as we know, the way everlasting of mental evolution, has been formed the potentiality of a moral sense. It will be understood of course that in the environing medium to which internal adaptation takes place human nature as well as physical nature is included; we have to take account in fact of the *social* medium, for it is as a unit in the social organism that the individual has attained by degrees through the course of ages to a moral sense and to his highest emotions and intellectual faculties. As man gets a knowledge of physical nature in order to act upon or modify it to his profit, his practical wants originating science, his necessity being the mother of his invention, so by study of his relations to human nature and corresponding action thereto he has attained to social intelligence and feelings, the highest of which feeling is moral feeling. He rises gradually to comprehend that he is a unit in a complex social organism, in which if one member suffers all members suffer with it, and in which the highest good of the whole and of the parts is one.

The larger, more numerous and complex cerebral convolutions which distinguish the brain of a civilized person from that of a savage correspond with the capacities of the exalted ideas of justice, virtue, mercy, love which the savage has not and cannot have; these demand for their full function and reproduce in their function the higher and more varied activity through which they were first developed in the race, displaying the kind of function which has determined, and is embodied in, the structure; the vesicular neurine has increased in quantity and quality, and the function of the more highly endowed structure is to display that intelligence and moral feeling which it unconsciously embodies. The order of events is presumably in this wise: by virtue of its fundamental adaptive property as organic matter, nerve-element responds to environing relations by definite action; this action, when repeated, determines structure; and thus by degrees new structure, or—what it really is—a new organ, is formed, which embodies in its substance and displays in its function the countless generalizations, so to speak, or ingredients of experience, which it has gained from past and contributes to present stimulation. Function makes capacity; and what I wish to make clear is that in the actual substance of the new structure which acquired capacity implies, are concentrated and embodied the multitudinous adapted responses to manifold impressions, simultaneous and successive, through which the growth and development of the structure have taken place. It is, as it were, an abstract of past experiences and adjustments, an embodied complexity of co-ordinations. The only way by which the low savage could be raised to the capacity of ideas and feelings belonging to the highest reach of human evolution would be by cultivation continued through many generations; it would be necessary that he should undergo a gradual process of humanization before he could attain to the capacity of civilization. Certainly it does not appear likely that he will survive the process as it has been undertaken and carried out by the united gospels of commerce and of Christianity; but there is no need to be sorry on that account, for why should we labour to carry on the evolution of the race by slow and tedious exaltation of the lowest specimens when we have higher specimens at hand available for the purpose?

Here may fitly be asked the pertinent question—Whence is derived the beginning or the first shoot of a moral sense? The answer which may be thought not so fit, but which nevertheless I propose to make, is that the root of the moral sense must be sought in the instinct of propagation. By the gratification of this instinct, notwithstanding that it is an act of pure self-indulgence, the individual does not appropriate matter to himself and increase, but dissipates energy, giving off from himself something which goes to propagate the species; the aim of the instinct being not to benefit the individual—for though its indulgence gratifies him he is the less by his gratification—but to inveigle him through self-gratification to continue the kind; it is not appropriative but distributive, not egoistic, so to speak, but altruistic. We have already had occasion to take note of the transforming effect which it produces upon the mental functions so soon as it declares itself in them, and it is obvious that, in animals in which the sexes are separate, its gratification involves at the least a temporary association of two individuals, and so initiates or marks an advance towards the social state. It is easy to perceive again that the affection which is entertained for the product of its activity and the constant and special care needed by the offspring bring into play the maternal or paternal instinct, thus modifying the primal instinct of self-preservation and carrying the individual at once out of himself into feeling for another, even though it be only a little way; he passes at any rate out of the circle of individual selfishness into the larger circle of family selfishness. Now family feeling, as Comte pointed out, is the foundation of social feeling; to cease to be governed entirely by personal instincts, and to begin to conform to an environment or external order of which individuals constitute a part, is to begin to be subject to social or rudely moral discipline, and to acquire a social or rudely moral feeling.

As the necessities of life compelled families to dwell together in some kind of unity the tribe was formed, and the interest and sympathies of the individual became one with those of his tribe; he passed from the circle of family selfishness into the larger circle of tribal selfishness; his nearest approach to a moral feeling was a tribal feeling. It was a momentous epoch, as has been remarked, in the development of the human race when it first became more or less clearly conscious that its maintenance and welfare depended upon association, for it could not but be that a primitive social feeling must spring from the relations of the individual to the social medium. The rudest association of men for the purposes of attack or defence in war must have led to the development of certain altruistic virtues in those who formed the fighting body; they could not otherwise have held together. The subsequent more complex associations of men would presumably after a time engender a higher public moral feeling, offences against the community being visited with severe punishment.

Among savages now, as was the case everywhere among mankind in the pre-moral ages, the ideas of immorality and criminality do not exist; if one is injured by another he takes his revenge, whatever that may be, and when he has done that he is satisfied.

It is an affair of private vengeance with which public morality is not concerned. A life for a life taken, or adequate compensation for it, and then, as Ajax said (*Iliad*, ix. 632—636), "The murderer remains among his own people, having paid a large compensation, and the injured person, having been compensated, is appeased and abandons his resentment." The Greek word used for compensation is ποινὴ, from which are derived the Lain *pœna*, the French *peine*, and the English *penal;* the idea of punishment having plainly sprung from the idea of compensation. For with the Greeks, as with other nations, when they became more civilized the enforcement of retribution for wrong done, whether as compensation or punishment, was taken out of the hands of the individual and became the affair of the community; and this was a great step upwards. When matters had reached this stage, the idea of punishment would predominate over that of compensation, and a certain public moral feeling in regard of offences would be engendered. The Germans, according to Tacitus, at the time when they came into conflict with the Romans, were much like the Greeks of Homer's time in their views of compensation for wrong done. Homicide was expiated by a gift of cattle, part of which was paid to the king or state, part to the injured person or his relatives; and when the transaction was completed, every one was satisfied and no stigma attached to the murderer. Among the existing Caffres development has gone so far that the atonement-money is not paid to the injured party but to the chief.

Among savages, however, an offence against the tribe was not so easily expiated, death being often the punishment. The idea of criminality could hardly fail to become attached to offences which were thus severely punished. Certain tribal virtues must obviously have been essential in order that the tribe might hold together, and maintain itself against other tribes with which it was in frequent conflict; the tribe which was most compact, which was held together by the strongest bond of coherence, being most likely to win in the struggle for existence. Now, that which was thus the strongest tie to bind individuals into an organized body, and to preserve their tribal existence, would be most highly esteemed or worshipped by the tribe, would in fact become its *religion;* a word, the derivation of which betrays its origin, if the grammarians are right in obtaining it from the Latin *religare* to bind fast. A sound morality being like the connective tissue of an organism, could not fail, even though of an elementary kind, to have been found so useful to a tribe that it would, like great foresight or prudent self-denial, have made it superior to other tribes that were without it; and so the primitive morality would become a religion, an offence against which would occasion horror and entail punishment. The history of the Jews, as recorded in the Bible, yields a striking illustration of the advantage of the strong bond of cohesion which they had in the possession of a special God, the God of Israel, more powerful than the gods of the heathen, and of laws of morality proclaimed by him through his favoured servant Moses, who had, moreover, the previous advantage of being learned in all the wisdom of the Egyptians.

But the moral feeling of the Jews was entirely national; the commandments thereof had reference to their relations with one another as a chosen people, not to their relations with other nations. It was lawful and right, for it was the direct command of Jehovah, to put to the sword the Canaanites whom they invaded—them and their wives and their children—and to make their children pass under the harrow. "Thou shalt do no murder" did not mean thou shalt not murder a Canaanite; "Thou shalt not steal" did not mean thou shalt not spoil the Egyptian and the Philistine; "Thou shalt not bear false witness" did not mean thou shalt not betray an enemy to his destruction by falsehood and guile.* So it was among other savage tribes or nations who had not reached so high a state of development as the Jews, by aid of the wisdom of Moses, had done: the individual conformed to the moral feeling of his tribe, but never dreamt that it had—what it could not well have had in those days—any application to the members of other tribes; it was a religion with him to do unto them what it was his religion not to do unto his own people.† No doubt we have reached a much higher pitch of moral feeling now, Christianity having theoretically broken down the barriers of isolation and proclaimed the universal brotherhood of man; but it is sad and humiliating to feel how small is the international application which good principles yet have. It is an odd satire on the profession of Christian doctrines which is afforded by the spectacle of two great armies worshipping the same God and professing the same religion of peace and goodwill among men, yet each on the eve of battle putting up earnest prayers to him to render its slaughter efficacious, and to give it the victory over those who are, with equal earnestness, invoking his special aid and protection. However, these are amusements which men will relinquish as they become wiser and better; and there can be no doubt that in the time to come, though the day may be yet afar off, there will be a progress from national to international moral feeling, as there has in times past been a progress from the family to the tribe, from the tribe to the nation; that men, perceiving clearly their interests to be one, shall learn to put the interests of humanity above those of the nation, and shall not learn war any more; that they will be bound compactly together by a strong feeling of brotherhood, and that this bond of religion will inspire their efforts to promote the welfare of humanity, and to further its evolution through the ages that must pass before the earth becomes either too hot by approaching the sun, or too cold by the extinction of the sun's fire, to sustain animal life upon its surface.*

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* The story of Jael and Sisera is instructive in this respect; the light in which she was regarded for her abuse of the sacred rite of eastern hospitality showing the limited range of moral feeling at that time:—"Blessed above women shall Jael the wife of Heber the Kenite be, blessed shall she be above women in the tent. He asked water, and she gave him milk; she brought forth butter in a lordly dish. She put her hand to the nail, and her right hand to the workmen's hammer; and with the hammer she smote Sisera, she smote off his head, when she had pierced and stricken through his temples. At her feet he bowed, he fell, he lay down; at her feet he bowed, he fell; where he bowed, there he fell down dead." (Judges v. 24—27).

† The wife of an Australian savage having died of some disease, he informed Dr. Lander that he would go and kill a woman of a distant tribe, so that his wife's spirit might have rest. Forbidden imperatively to do so, and threatened with imprisonment if he did, he became wretched and wasted away; but he disappeared eventually, and was absent for some time. When he reappeared he was in good condition, for he had succeeded in killing a woman; his sorrow because of a sacred duty omitted had disappeared, his tribal moral feeling was satisfied, and his bodily nutrition sympathised with the restored animation of his mind.—*American Journal of Insanity*, July 1871.

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* The narrow and vulgar patriotism which takes the form of asserting and upholding the interests of a nation, whether they be the interests of justice and humanity or not, is a different thing from, and of a lower order of virtue than (if it be a virtue) the true patriotism which animates the individual who sacrifices his own interests and, if need be, his life for his country. It is plain that the righteous nation should subordinate its interests to those of humanity, as the patriotic individual subordinates his interests to those of his community or nation. The authorized British prayer for the head of the state—"grant her in health and wealth long to live; strengthen her that she may vanquish and overcome all her enemies," be her cause

In the growth, in range and power, of the moral element in human nature which marks its slowly proceeding evolution, we see clearly exhibited a vast modification of the operation of the law of natural selection by means of the moral law. Whereas it is conformable to natural selection that the strongest should make the best use of its strength for its own advantage, and that the weak, falling by the wayside in the struggle for existence, should be trampled upon, the moral law, as it has received its latest and highest exposition in Christian doctrine, ordains that those who are strong shall raise up them that fall; that those who are in joy shall comfort those that mourn; that those who are prosperous shall help those that are in affliction and distress; that man on all occasions shall do unto another as he would have another do unto him, not using his advantages with eager selfishness for his own profit, but having in all he does a larger reference to the good of his kind. It is the survival not of the fittest individual organism, but of the fittest social organism, or rather the fittest organism of humanity, which is the effect of its operation — the compact cementing of human interests into solidarity by the practical recognition of universal brotherhood, which, being its probable effect through the ages to come, we may venture to foresee, and to describe accordingly, as its aim now. Mr. Darwin has pointed out very clearly how the operation of the law of natural selection is largely modified in the lower animals by the operation of the law of sexual selection; and it is interesting to observe how we are brought back to sexual association in man when we go backwards over the course of the gradual development of moral feeling, and trace it to its early beginnings in the family; and how, groping our way

right or wrong—characteristic as it is of the spirit of the country, has a strong strain of Philistinism in it, which suits not well with the expansion of moral feeling.

still further back, we can go down at last to the instinct of propagation in which, believing it to contain the prophecy of a social organism, I have proposed to find the root of the moral sense.

Having clearly realised that the individual rightly developing in his generation is, by virtue of the laws of hereditary action, ordaining or determining what shall be pre-ordained or pre-determined in the original nature of the individual of a future age, it behoves us not to lose sight of the physical aspect of this development. The moral feeling betokens an improved quality or higher kind of nerve structure, or an additional development of structure, which ensues in the course of a right development, and which may easily again be disturbed by a slight physical disturbance of the nervous element. In the exaltation of mankind through generations—in the progress of humanization, so to speak—this height of excellence is reached: in the deterioration or degeneration of mankind, as exhibited in the downward course of insanity proceeding through generations, one of the earliest evil symptoms is, as we shall hereafter see, the loss of this virtue—the destruction of the moral or altruistic feeling. Its formation is a matter of organic evolution; its destruction a matter of organic dissolution. Insane persons are entirely wrapped up in self, though the self-feeling may take many guises.

The intimate and essential relation of emotions to ideas, which they equal in number and variety, is sufficient to prove that the law of progress from the general and simple to the special and complex prevails in their development. If such relation were not a necessary one, it would still be possible to display that manner of evolution from a consideration of the emotions themselves. And the recognition of this increasing specialization and complexity in the function compels us to assume a corresponding development in the delicate organization of the nervous structure, although, by reason of the imperfection of our means of investigation, we are not able to trace a process of so much delicacy in those inmost recesses to which our senses have not yet access.

NOTES.

[1] (*p.* 349).—"Notre âme fait certaines actions et souffre certaines passions; savoir: en tant qu'elle a des idées adéquates, elle fait certaines actions; et en tant qu'elle a des idées inadéquates, elle souffre certaines passions."—SPINOZA, *Des Passions*, Prop. i.

[2] (*p.* 352).—"Among so many dangers, therefore, as the natural lust of men do daily threaten each other withal, to have a care of one's self is so far from being a matter scornfully to be looked upon, that one has neither the power nor wish to have done otherwise. For every man is desirous of what is good for him, and shuns what is evil, but chiefly the chiefest of natural evils, which is death; and this he doth by a certain impulsion of nature, no less than that whereby a stone moves downwards."—HOBBES, vol. ii. p. 8.

[3] (*p.* 353).—"Le désir, c'est l'appétit, avec conscience de lui-même. Il résulte de tout cela, que ce qui fonde l'effort, le vouloir, l'appétit, le désir, ce n'est pas qu'on ait jugé qu'une chose est bonne: mais, au contraire, on juge qu'une chose est bonne par cela même qu'on y tend par l'effort, le vouloir, l'appétit, le désir."—SPINOZA, *Des Passions*, Schol. to Prop. ix.

[4] (*p.* 358).—"But we must frankly admit, on consideration, that the political rule of intelligence is hostile to human progression. Mind must tend more and more to the supreme direction of affairs; but it can never attain it, owing to the imperfection of our organism, in which the intellectual life is the feeblest part; and thus it appears that the real office of mind is deliberative; that is, to moderate the material preponderance, and not to impart its habitual impulsion." —COMTE, *Positive Philosophy*, vol. ii. p. 240. (*Martineau's Abridgment.*) See also *Positive Polity*, *passim*. It was a fundamental maxim of his philosophy, "We act from affection: we think in order to act." Notwithstanding that the intellectual powers increase in importance as we rise in the scale of animality up to man, "these functions never become, even in our own race, the principal and permanent motors of existence. The real unity of life depends invariably upon affection of one kind or another."

[5] (*p.* 361).—"For it is not his disputations about pleasure and pain that can satisfy this inquiry; no more than he who should generally handle the nature of light can be said to handle the nature of particular colours; for pleasure and pain are to the particular affections as light is to particular colours."—BACON, *De Augment. Scient.*

"Autant il y a d'espèce d'objets qui nous affectent, autant il faut reconnaître d'espèces de joie, de tristesse, et de désir; et en général de toutes les passions qui sont composées de celles-là, comme la fluctuation, par exemple, ou qui en dérivent, comme l'amour, la haine, l'espérance, la crainte," &c.—SPINOZA, *Des Passions.*

[6] (*p.* 364).—"Mais il faut en outre remarquer ici qu'il n'est nullement surprenant que la tristesse accompagne tous les actes qu'on a continué d'appeler *mauvais*, et la joie tous ceux qu'on nomme *bons*. On conçoit en effet par ce qui précède que tout cela dépend surtout de l'éducation. Les parents, en blâmant certaines actions, et réprimandant souvent leurs enfants pour les avoir commises, et au contraire en louant et en conseillant d'autres actions, ont si bien fait que la tristesse accompagne toujours celles-là et la joie toujours celles-ci. L'expérience confirme cette explication. La coutume et la religion ne sont pas les mêmes pour tous les hommes: ce qui est sacré pour les uns est profane pour les autres, et les choses honnêtes chez un peuple sont honteuses chez un autre peuple. Chacun se repent donc ou se glorifie d'une action suivant l'éducation qu'il a reçue."—SPINOZA, *Des Passions*, p. 159.

[7] (*p.* 365).—Many illustrations might be adduced from Shakspeare's plays of the wonderful harmony between the highest human feelings and the aspects of nature; some of these I have pointed out in an essay on *Hamlet* in the *Westminster Review* of January, 1865. The best known passage is that in the *Merchant of Venice*:—

"Sit, Jessica. Look how the floor of heaven
Is thick inlaid with patines of bright gold.
There's not the smallest orb which thou behold'st
But in his motion like an angel sings,
Still quiring to the young-eyed cherubin:
Such harmony is in immortal souls;
But whilst this muddy vesture of decay
Doth grossly close it in we cannot hear it."

Again, Milton in his *Arcades:*

"But else in deep of night, when drowsiness
Hath locked up mortal sense, then listen I
To the celestial Sirens' harmony,

That sit upon the nine enfolded spheres,
And sing to those that hold the vital shears,
And turn the adamantine spindle round,
On which the fate of gods and men is wound.
Such sweet compulsion doth in music lie,
To lull the daughters of necessity,
And keep unsteady Nature to her law,
And the low world in measured motion draw
After the heavenly tune, which none can hear
Of human mould with gross unpurged ear."

Sir T. Browne, in his *Religio Medici*, says: "It is my temper, and I like it the better, to affect all harmony: and sure there is music even in the beauty and the silent note which Cupid strikes, far sweeter than the sound of an instrument: for there is music wherever there is harmony, order, or proportion; and thus far we may maintain the *music of the spheres;* for these well-ordered motions, and regular paces, though they give no sound to the ear, yet to the understanding they strike a note most full of harmony. . . . . It is a hieroglyphical and shadowed lesson of the whole world, and creatures of God; such a melody to the ear, as the whole world, well understood, would afford the understanding." Passages of like import might be quoted from Goethe, Jean Paul, Humboldt, Emerson, Carlyle. and many other writers.

CHAPTER VII.

VOLITION.

"Les hommes se trompent en ce point qu'ils pensent être libres. Or, en quoi consiste une telle opinion? En cela seulement, qu'ils ont conscience de leurs actions et ignorent les causes qui les déterminent. L'idée que les hommes se font de leur liberté vient donc de ce qu'ils ne connaissent point la cause de leurs actions, car dire qu'elles dépendent de la volonté, ce sont là des mots auxquels on n'attache aucune idée. Quelle est en effet la nature de la volonté, et comment meut-elle le corps, c'est ce que tout le monde ignore, et ceux qui élèvent d'autres prétentions et parlent des siéges de l'âme et de ses demeures prêtent à rire ou font pitié."—SPINOZA, *Saisset's Translation.*

"En tout, ce que je puis dire à ceux qui croient qu'ils peuvent parler, se taire, en un mot, agir en vertu d'une libre décision de l'âme, c'est qu'ils révent les yeux ouverts."—*Ibid.*

IT is strange to see how some, who confidently base their argument for the existence of a God on the ground that everything in nature must have a cause, are content, in their zeal for free-will, to speak of the will as if it were self-determined and had no cause. As thus vulgarly used, the term Will has no definite meaning, and certainly is not applicable to any concrete reality in nature, where, in the matter of will, as in every other matter, we perceive effect witnessing to cause, and varying according as the cause varies. Nor is this the only inconsistency which those who vindicate a metaphysical will are apt to perpetrate. While holding that there is an impassable gulf between the conscious and the unconscious, and pronouncing the connection between matter and mind to be unthinkable, they declare in the same breath that they have incontestable proof of the existence of will in the distinct consciousness which they have of the power of producing motion of their limbs by an act of volition. In other words, every moment of their lives almost they pass a gulf which they declare to be impassable, think a connection which they declare to be unthinkable.

Let it not be thought that I shrink from encountering a difficulty fairly if I pass rapidly over the long-standing dispute concerning free-will and necessity. It would be vain to pretend to throw any new light upon a subject which has been discussed over and over again, although it must be admitted that the result, owing perhaps to ambiguity in the terms used, has commonly been to leave matters much as they were, and the opponents on each side convinced that they have gained the day. Certainly to one who looks at the matter with the naked eye of common sense it would appear that the term free, if properly used, should be used of the man, not of his will; if he be free to do as he pleases, in other words, as he wills, he is free; if he is hindered from doing so by internal or external causes, or is obliged to do something else, he is not free; a will free to will itself strikes one as simply nonsense. The question, however, is one which will not be settled by controversy, but I cannot doubt that it will be settled gradually, without need of controversy, by the progress of human knowledge; the time being probably not far distant now when men will wonder that so much subtile ingenuity and zealous labour should have been bestowed upon it. They will awake some day to be conscious that there is no question for discussion, that mankind has solved it by marching, and that it only remains to display explicitly in knowledge what is implicit in action.

The advocates of the doctrine of the so-called freedom of human will—for animals are excluded from the benefit of it—declare that every man's consciousness witnesses emphatically that he can choose arbitrarily between two motives, and that he is often free to do or to abstain from doing what he does; wherefore they maintain that the will is free. Their opponents retort, in an equally precise and dogmatic way, that there is a uniform conjunction between motive and act, that the will follows the strongest motive, and that human actions, like all other natural phenomena, conform to constant laws; wherefore they maintain that the word free-will is an unmeaning absurdity, and that the notion of a free will in the microcosm of man is the equivalent of the exploded notion of chance in the macrocosm of the universe. Such are the conflicting theories of the opposing sides. Meanwhile all human institutions, as well as human conduct, are practically founded on a recognition, implicit or explicit, of the reign of law in the province of mind: education, the penal code, social regulations, legislative enactments rest upon this basis, and emancipation from their sanctions is treated as crime or insanity. The plain design of these enactments is to constrain people to act in a certain way, by supplying the motives which shall determine the will; and the result of experience assuredly is to prove that they are efficacious, for the world goes on making systematic use of them, which it would not do if they were not proved efficacious by trial, that is to say, if the constancy of their action were liable to be interrupted at any moment by a capricious, arbitrary, free will, such as metaphysicians have imagined and theologians have extolled. Brethren could not dwell together in unity, human society would in fact be impossible, if men were not able to reckon upon one another's thoughts, feelings, and actions under certain conditions; but they do rely on the general uniformity of human character and conduct as they rely on the uniformity of physical nature, because there is a uniformity in the operations of moral causes or motives as there is in the operations of physical causes.*

A self-determining will is an unmeaning contradiction in terms and an inconceivability in fact; were there such a power, there would be no reason to be surprised at any act which a man might do, or to reprobate it, however criminal; for to suppose a man to act by reason of it, without its being influenced by reason, would be to suppose him worse than a madman. Insane persons do not conspire in asylums, because they cannot reckon upon one another, and do surprise and alarm sane persons by their conduct, because it so often presents a deviation from the uniformity of action of moral causes. Were the will free, as supposed, madmen would exhibit the most free wills, inasmuch as their conduct would be the least to be predicted. Animals which hunt in packs, or live in herds, so hunt or live because they depend upon constancy of action in each member, at any rate under the limited conditions of their union. The antipathy and opposition which mankind show to a new idea when it is first promulgated is probably due in great measure to the shock which it occasions to the uniformity of their ideas and feelings; there is an instinctive repugnance to, or apprehension of, a power which appears to be arbitrary, irresponsible and, so far as antecedents are concerned, free. This hostility or want of receptivity is most marked among savages, whose mental structures are less complex, and more simple and uniform in their operations; they can conceive no further justification of a custom, however foolish, to be needed than that it was the custom of their fathers, and no other justification of their antagonism to something new, however excellent, than that it was not the custom of their fathers. But one need not go to savages in order to discover that want of plasticity to accommodate the mind to new impressions by reason of which the reformer is in the first instance almost always reviled and rejected as an enemy of the race. He whose hand or thought is against every one will have every one's hand or thought against him; if he can convince mankind that his new idea is not capricious, undetermined, and hostile to their mental organisation, but that it really proceeds from it and represents a development of it, they will accept it in the end, though they may have stoned, crucified, poisoned, or otherwise made a martyr of its author in the first outburst of their antipathetic fury. The whole nature of a belief may be transformed, without those who hold it ever receiving any shock from the change, if the new be allowed to gently insinuate itself into the old and to be called by the old name: they then let go the old and embrace the new without realising the transformation which has taken place.

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* The general uniformity of human beliefs, and the more special uniformities of beliefs among different parties, sects, nations, are instances of corresponding internal adaptations to corresponding external impressions. What else at bottom is a belief than the self-conscious aspect of an excito-motor process in the cerebral convolutions? It is an induction from experiences—a conviction that when certain impressions are made upon the senses, certain other definite impressions will be received from certain adapted motor reactions. There is always some feeling in the process, but the belief gains in intensity according to the strength of the feeling or affective element which enters into the process. Of course, it is not possible on all occasions to make the adapted motor reactions, but one learns from the experiences of others as well from one's own, and generalises from particular experiences as to the permanent possibilities of similar definite impressions, could the experience ever be made. A belief then is my conviction that I, if acted upon by certain impressions, can or might react definitely upon that which has produced them, and gain thereby other definite impressions.

It would appear, then, that in the practical arrangements of life mankind could not evince more distinctly than they do their tacit conviction of the uniformity of events, both in the psychical and the physical worlds; in other words, their tacit recognition of the fact that every event, mental or physical, is a necessary effect o certain antecedent conditions, invariably produced when they are present, and never produced when they are absent. No man thinks it absurd to be asked why he thought, or spoke, or acted in a particular way, or would be flattered by the supposition that he had no motive or reason for what he said or did. Men may amuse themselves with theoretical discussions about free-will, but the provisions which they make practically for their welfare are not disturbed by any doubt of the uniform sequence of events in psychical nature. When they shall have succeeded in displaying explicitly in reasoned exposition what is implicit in their social evolution, there will be an end of the controversy respecting free-will.

How comes it to pass, then, that, while so hostile practically to free-will, feeling that it would entail the dissolution of society, they nevertheless hold to it and extol it as the foundation of morality? When a person who perpetrates a crime, not being insane, is punished, he is punished because he is deemed to have had the freedom not to have done it; at the same time a main object of the punishment is declared to be to supply an adequate motive to prevent him and others from perpetrating a similar crime —to infuse such motives into his character as shall make its expression in will more laudable. To reconcile the theory of freedom openly proclaimed with the theory of necessity tacitly acknowledged, the man is considered to have acted with free-will in the past, whereby is a justification of the punishment as an atonement or an act of social vengeance; but it is thought right that his will should be constrained or determined by a sufficiently powerful motive for the future, whereby the infliction of punishment is made to rest on a rational basis. For it is plainly a rational thing on the part of society to determine the individual by his own sufferings, or by the example of the sufferings of others, to do that which shall conduce to the social welfare, and to abstain from doing that which is detrimental to it—to make him a social being who shall discharge his proper functions in the social organism, and to prevent him from becoming an antisocial being who must be isolated in prison or asylum, and made functionless in it; and what is this but the practical repudiation of the doctrine of free-will? On the other hand, the idea of punishment as a vengeance or an atonement for crime, which still lingers in the criminal law, is irrational, and based upon the metaphysical doctrine of free-will; it is in truth a survival of the superstitious ideas which find their strongest expression in the doctrine of eternal punishment. Neither reformation of the individual nor any benefit of example to others can be thought of in regard to the end of the world and the day of judgment: there can be no reformation, for the sentence is eternal; there can be no benefit of example, for the saints in heaven need it not, having secured eternal bliss, and the damned cannot profit by it, as their doom is irreversible; for it may be noted as a defect in the economy of hell that there is no graduation of its fires according to the measure of culpability or to the degree of remorse. The entire basis of the doctrine of eternal punishment is fiendish vengeance.*

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* We lift up our hands and eyes in horror when we read of the tortures and cruel deaths habitually inflicted by the barbarous tribes of Africa under the influence of their savage superstitions. Let us emancipate ourselves from the custom of our own ideas, and endeavour to see ourselves as we see others, and as others will some day see us. Has there been in all history anything so gratuitously horrible and barbarously superstitious, anything evincing such a superfluous ingenuity of cruel imagination, as the doctrine of the condemnation of all but a select few of the human race to the most

It is not difficult to understand why men should have conceived the doctrine of free-will, and why they should have advocated it as the foundation of morality. They were wise in their generations. Self-consciousness does undoubtedly reveal in relation to many acts a balance of motives so nearly equal that it is impossible to predict on what side the determination shall fall. The question being whether we shall do a particular act or not, and the act being an indifferent one, there is no preponderant motive for doing it or from abstaining from doing it; accordingly the result, whatever it be, looks like an arbitrary determination of the will, which of its own motion has given the preponderance to one motive, more especially when the result has proceeded from a caprice of showing freedom.(1) But is it really so ?[*] Or does

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agonizing tortures through all eternity? Is there anything so ridiculously inconsistent as that amiable persons who go on believing and promulgating that doctrine, and finding much spiritual comfort in it, should grieve over stories of African cruelty and superstition? Perhaps the time will come, though it be yet afar off, when Milton's *Paradise Lost*, with its story of the fall and doom of man, will be as surprising evidence of the state of intellectual development of mankind of this age as the split bones of human thighs, discovering the marrow-eating propensities of our savage ancestors, are to us of the state of their development.

[*] The advocates of free-will do not mean that between motives and volition there is no relation whatever; what they seem to assert is that the conjunction of motive and volition is not inseparable like that of cause and effect in physics; that there is an arbitrary or self-determining power which enables men to choose any one of two or more motives present to the mind, and to make that the operative motive. But this theory only complicates the question without making the least step towards solving it; for it is obvious that so far as the power is assumed to be exempt from all influence, to act from a higher region upon the motives, to be absolutely free, there is an assumption of the entire question; there is an assumption of a miraculous, supernatural power, subject to no laws, deriving its energy from we know not where, and not therefore in any sense measurable, which may do just as it pleases with motives. It is a small matter, therefore, on this theory, whether motives are

self-consciousness deceive us in the matter, revealing to us the determination come to and the foregoing indecision, but not making known to us all the conditions, embodied in our mental organization, on which the issue has actually turned. Not only what we have felt and thought and done in our lifetimes, but that which our forefathers have felt and thought and done in their lifetimes, entering into the constitution of the *ego*, will operate in the determination which we come to either to do or not to do the most trivial and apparently indifferent act. Now it is plain that self-consciousness tells us nothing of all this; as a temporary condition of the *ego*, it reveals the particular mental state of the moment, but tells us nothing of the manifold conditions or latent motives, tacitly acting, on which the *ego* or seeming free-will of the moment depends. How, then, can consciousness undertake to deny the existence of what it can take no cognizance of? It is not a witness at all in such a case, any more than a man who observes what takes place in the light is a witness to what is taking place in the dark. And in truth when we think we are acting with most freedom, because acting after full deliberation with confident decision, unimpeded by any conflict of motives, we are most determined by conditions of our nature that are beneath consciousness and beyond control. On the other hand, the firmest resolution or purpose sometimes vanishes issueless when it comes to the brink of the act, while the true will, which determines perhaps a different act, springs up suddenly out of the depths of the being, the unconscious surprising and overcoming the conscious

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admitted or not; for it would be just as easy to assume—and as impossible to conceive—an arbitrary self-determining power which could do without motives as to assume one which works by picking and choosing among motives, and, like a capricious despot, pleases itself by making the least greatest and the greatest least according to the whim of the moment.

nature; so that until action has taken place we cannot be certain what was the real will.*

"By their fruits ye shall know them" is as true of self-knowledge as of the knowledge of others; but as we cannot view our own deeds with impartial eye, it often happens that other people know us better than we know ourselves, and that we sincerely condemn in another person's character what we are complacently satisfied with in our own. Could we penetrate the closest recesses of a character, and make ourselves intimately acquainted with all its inherited and acquired impulses, knowing them as we know the properties of a chemical compound and of its component elements, we could foretell with certainty how the individual would act in any given circumstances; but although we cannot thus reason forwards from unknown data, we can reason backwards from known data; knowing what his acts and circumstances have been we may know his character, for they declare what he has willed or failed to will, and what he has willed or failed to will, as read in his history, declares his character. To suppose that the acts of a man's life, or any of them, are determined by a power which, in so far as it gives the preponderance to one of two motives, is assumed to be entirely arbitrary, absolutely exempt from all influence, supernaturally infused, *free*, is as wild a dream as ever entered into the imaginations of metaphysicians to conceive. Were it true, all attempts to acquire a knowledge of human nature would be illusory and futile, and experience of men would go for nothing in the practical affairs of life.

The aim of education in relation to the sphere of moral action is to produce a nature in which moral action shall be not a matter of uncertainty and deliberation, but a habit; in other words, a nature in which spontaneity shall disappear in automatism. Strange contradiction! for the man in whom moral action had thus become habitual or automatic would be considered to have a stronger and more free will than one in whom it was an inconstant result of deliberation. This brings me to consider why the doctrine of free will has been advocated as the basis of morality. Moral action is certainly a necessary condition of the evolution of the social organism, that is, of the progress of the human race: the inductions of experience have not failed to teach men *that*. It is certain, too, that the desires of most men in times past were, and perhaps still are, selfish, and that the tendency of such desires is to become anti-social. The aim of education, social sanctions, legal enactments is, therefore, to check the selfish and anti-social inclinations by supplying a powerful body of suitable motives, and to implant and foster the moral or altruistic feelings which shall promote the evolution of the social organism. In this way the social community of one age strives to form the social units of the following age; to establish in regard of social relations a harmony in one generation which shall be a pre-established harmony of nature in the generations that follow. Such is the process expressed in terms of physiology, although it would be expressed otherwise in terms of religion. Now, how can men on each occasion be most powerfully instigated to seek good and ensue it, when the balance of personal desires and propensities is commonly on the opposite side? Clearly by inculcating in the most impressive manner possible the doctrine of freewill and responsibility, at the same time that are presented to them the strongest motives for moral action which can be fabricated—namely, the most vivid pictures of the unspeakable joys of heaven as the reward of well-doing, and of the endless torments of hell as the punishmen of ill-doing. In this way we constrain them at the critical moment by a powerful motive to act rightly, and aim, by enforcing the repetition of right acts, to foster a habit of acting rightly, and to work by degrees a better nature in them; for each moral act, by the law of nervous action which has been already illustrated largely, renders the next more easy, and so the nature is gradually modified. The process is really one of moral manufacture. When a habit of nature has thus been formed, the desire of the organism is to display that function which is embodied in its nature, and the pleasure of gratifying the desire by doing right is itself a sufficient motive.* Then the individual is said to have acquired the greatest strength and to manifest the most perfect freedom of will, because he is able to do right easily in the midst of ever so many temptations to do wrong; and thus the highest freedom of will is cleverly identified with the highest morality. Liberty is the voice of conscience; conscience is the voice of God, say the theologians.†

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* Below the surface-stream, shallow and light,
Of what we *say* we feel—below the stream,
As light, of what we think we feel—there flows
With noiseless current strong, obscure and deep,
The central stream of what we feel indeed.

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* "In the great majority of things, habit is a greater plague than ever afflicted Egypt: in religious character, it is eminently a felicity. The devout man exults to feel that in aid of the *simple* force of the divine principle within him, there has grown by time an accessional power, which has almost taken the place of his will, and holds a firm though quiet domination through the general action of his mind. He feels this confirmed habit as the grasp of the hand of God, which will never let him go."—*Essays.* By John Foster.

† The Divine grace helping, one might perhaps add. For they seemingly deem not that kind of influence inconsistent with the perfect freedom of the will, any more than they deem the instigations of the devil anywise inconsistent with the entirely spontaneous origin of evil thoughts and actions. But they do not shrink from inconsistencies; for while they admit the growth and development of the will to take place by education and exercise, they still declare the power so gained to be absolutely free, to owe nothing to that which has made it, to be independent of its causation; and to be most free when it has become a confirmed religious habit which the individual feels "as the grasp of the hand of God, which will never let him go!"

It would appear then from what has been said that the doctrine of free-will, like some other doctrines that have done their work and then, being no longer of any use, have undergone decay—comparable with certain bodily organs, like the thyroid gland, which have their functions in early development and then, not being wanted afterwards, undergo atrophy—was necessary to promote the evolution of mankind up to a certain stage. By inculcating strenuously upon the individual his absolute freedom of will, and by laying the greatest stress upon his personal responsibility for what he does, it is evident that we add greatly to the force of the motive which we present to induce him to do right. On the one side is the motive to do right, on the other side is the motive to do wrong—the former more difficult, the latter more easy to do; by proclaiming free-will we strengthen the former motive, while by proclaiming necessity it is clear that we should strengthen the latter motive, in the unenlightened or inferior person who, with shortsighted ignorance, would gladly go the easy way of his passions rather than the arduous way of his true welfare. The notion of free-will and its responsibilities was necessary, therefore, and perhaps still is, to make for him a higher necessity than the necessity of his passions. But it does not follow that it ever was or is now necessary for him whom Confucius would have described as the sage or superior person, who looks to the endless consequences of his actions. To him the clear recognition of the reign of law in the human mind will furnish the strongest motive to do right, so to promote his own best development, and through individual development the development of the race, the highest interests of which he plainly perceives to be one with his highest welfare; while the doctrine of free-will will appear to be an effete superstition, the offshoot of ignorance, mischievously drawing men's minds away from the beneficial recognition of the universal reign of law and of their solemn responsibilities under the stern necessity of universal causation.

Having said all that it seems necessary to say here concerning the question of free-will, I go on now to sketch, so far as practicable, the physiological condition of volition. But, I may remark first, by the way, that we may be helped to trace the genesis of the will by looking to the original meaning of the word and to its use in common speech. We obtain the word from the Latin *volo*, which meant what a person *wished* or *would;* so that here we come to the *desire* or *wish* as the fundamental element of will. Jonathan Edwards has argued that there is no fundamental difference between *volition* and *preference;* a man's choosing, liking best, or being best pleased with a thing, being the same with his willing it. "Thus an act of the will is commonly expressed by its *pleasing a man* to do thus or thus; and a man doing as he *wills*, and doing as he *pleases*, are the same thing in common speech." If some one were advised to pursue a certain course, and, impatient of advice, were to declare angrily that he would do as he *liked* or *pleased*, he would no doubt believe that he was claiming and maintaining his freedom of will; his adviser, if an acute psychologist, would see good reason to entertain a different opinion. Certainly the man would be claiming his freedom of choice between two desires or motives—his freedom to follow his own choice and not another man's; and this freedom of choice is nothing else than what is often incorrectly described as the freedom of will to make the choice; for the so-called freedom of will is the expression of the likings or affinities of the man's character, and turns out, when closely analysed, to depend upon all that has gone before to constitute his present nature and inclination. If, overpowered by motives presented forcibly to his mind by others, he were to do something which he did not like, contrary to his inclination to do something which he liked better, he would perhaps say that he had done it unwillingly, which would be nonsense; for how could he have done unwillingly that which was a present act of will operating in opposition to the deep inclinations of his nature? But that act of will, however wise and good it may have been, was in no sense free; it was the direct consequence of the powerful motives excited in his mind by the persuasive arguments of other persons, which overmastered for the occasion the less conscious impulses of his nature. But these latter will not fail to come up again, and the man's habitual actions will be in conformity with his nature, which, though it may be silenced for the nonce, can never be expelled.

What in any event it shall please or like me to do will depend upon my original and acquired nature, bodily and mental—upon all that has gone before, either in the way of inheritance from ancestors or of modification by education and the circumstances of life, to constitute my present complex *ego*; and although I may hold that, in acting, I have really acted in conformity with the strongest desire or motive, it does not at all follow that it shall always have been a distinctly-formed motive, of which I am clearly conscious and which I can set forth exactly to others; on the contrary, the difficulty sometimes is to say what was the real motive, this having been of a complex character, and the motive sincerely believed and declared to have actuated me not having perhaps been the real one. Nevertheless, it can admit of no doubt that I did act as it liked or pleased me best under the actual circumstances to do—that the then inclinations or likings of my nature were declared in the deed—that the act of will was the expression of the affinities and energy of my *ego* at the moment. Common language describes the facts truthfully enough; it is metaphysical ingenuity, attempting subtile analysis by a wrong method, which has made confusion. Instead of analysing the concrete elements of individual character and forming a body of sound inductions, it has constructed an ideal mental philosophy, of which free-will is the chief corner stone.

It is not difficult to see how philosophy was induced to desert the solid ground of facts for the region of abstract entities in its dealings with will. Though will has its fundamental basis in desire, yet in the mind of a cultivated person desire, when it issues not immediately but mediately in action, undergoes so many processes of refinement in the manifold interactions of reasons and feelings which we call deliberation, that its original character as the motor factor in volition is masked. We get to a higher stage of life in which there is an infinitely complex co-ordination and subordination of functions. The desire enlightened by reason, as it comes out from the mental crucible through which it has passed, is of so much more refined and abstract a nature that it claims a new name, and is accordingly called will. The next step is to lose sight of the concrete acts of will, and to convert the general term into an abstract entity, which is supposed to have arbitrary powers. It would be just as reasonable to invent an abstract faculty of desire existing independently of particular desires, and operating with arbitrary power in them. Besides the distinct consciousness which we have of the formation of volition, after we have gone through the deliberations from which it has issued, we are certainly conscious of a distinct feeling of energy or power which is inseparably associated with every active movement that we make. It is through this feeling, which we have not when a part of our body is moved by others, that we are conscious of our own effort, whether the effect be a movement, or, if outward resistance be too great, not; and it is presumably conveyed to us by the muscular sense. Now it is obvious that this consciousness of effort, or feeling of innervation, is well suited to suggest the notion of a distinct power or faculty capable of acting with abitrary energy. On the one side we have the distinct consciousness of a volition, most of the antecedents of which are clean out of sight; on the other side, we have the distinct consciousness of a power or energy when the volition becomes active. What more was needed to generate the illusion of a free-will? But the testimony is one thing, the interpretation thereof another: we may trust consciousness as a witness to the fact of experience; but its testimony covers no more than that, and we cannot rely upon it as to the interpretation of the fact. It makes known the volitional energy of the moment; it reveals not the derivation of that energy. When a person regrets a certain act, and affirms that he would do otherwise if he were in exactly the same circumstances again, it is an illusion; if the circumstances were exactly the same, it would be impossible for him to do otherwise than as he did; but if he introduces a new element derived from subsequent reflections, he might no doubt do differently, only he should then perceive that the conditions have been changed, and a new factor introduced to operate upon the will. It is by overlooking the new element which is now introduced into his deliberation that he imagines he might have done otherwise on the first occasion.

These considerations, with others that have been brought forward in foregoing chapters, must have sufficiently proved the necessity of modifying the notion commonly entertained of the will as a single, undecomposable faculty, of constant and uniform power. It has been shown that under the category of voluntary acts, as commonly made, are included very different kinds of actions proceeding from different nervous centres; and it has been shown that we must either acknowledge each of these centres to have its own volition, and human will to be divisible into as many parts as there are nervous centres, or we must recognise in what are called true voluntary acts of the convolutions the display of the same fundamental properties of nervous tissue which the lowest nervous centres display. A considerable proportion of the daily actions of life is confessedly due to the automatic functions of the spinal cord; the sensory centres are clearly the independent causes of other actions; while many of the remaining actions that would by most people be deemed volitional are really respondent to idea or emotion. Each nervous centre embodies in its nature a quantity of energy of a very high order, accumulated by nutrition, which it is ready to discharge in its proper function on the occasion of a suitable stimulus. This just discrimination of functions is, notwithstanding, entirely neglected by those who take the metaphysical view of will; by them the abstraction from the particular is converted into an entity, and thenceforth allowed to tyrannize in the most despotic manner over the understanding. The metaphysical essence thus created has no other relation to a particular or concrete act of will, than, using Spinoza's illustration, *stoneness* to a particular stone, man to Peter or Paul.

It is obviously, then, of importance, in the first place, to get rid of the notion of an ideal or abstract will unaffected by physical conditions, self-determining, as existing apart from the particular concrete acts of will which vary according to physical conditions. When a definite act of will is the result of a certain desire modified by reflection, it represents physically a force available for action, consequent on the communication of activity from one nerve-circuit to other nerve-circuits within the cortical layers of the hemispheres; the final issue of the transformation of energy being the impulse of volition. Any modification, therefore, of the condition of these centres may, and notably does, impede reflection, and affect the resultant power of will—a power which, in reality, is seen to differ both in quantity and quality in different persons, and in the same person according to the varying conditions of the nervous substratum. Let a disturbance of an abdominal organ modify the affective tone of the brain, the will instantly reflects, in its impaired energy, the disturbing change. Divide the nerve going to a muscle, and the will issues its edicts in vain to the muscle; it cannot leap over the narrow gap made in the continuity of the nerve; for that which passes is a molecular motion along physical paths, easily and absolutely barred by physical hindrances to conduction. On the other hand, speaking psychologically, the definite will is the final issue of the process of reflection or deliberation which a man's life-culture has rendered him capable of; it represents a *conception* or *idea* of the result with *desire*, such as have been determined by the character of the reflection. A man can never will a virtuous end into whose reflection ideas of virtue do not enter, nor can any one will an act of vicious indulgence whose appetites or desires have not been vitiated, and whose mind is not familiar with corresponding ideas. The will appears, then, to be radically the desire, or aversion, sufficiently strong to produce an action after reflection or deliberation — an action which, as Hartley observes, is not automatic primarily or secondarily.*(2) Since, then, it is generated by the

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* "Appetite, therefore, and aversion are simply so called as long as they follow not deliberation. But if deliberation have gone before, then the last act of it, if it be appetite, is called *will*; if aversion, *unwillingness*."—HOBBES.

"In a series of valuable articles "On the Nature of Volition," in the *Psychological Journal* for 1863, Dr. Lockhart Clarke enters into an able analysis of the different forms of volition, and shows that in each case the process consists in the co-operation of two of the psychical elements which together constitute our personal integrity; namely, the intellectual or *regulative* element, and the æsthetic or *dynamic* element, the latter being either a sensation, an appetite, or preceding association, it must needs differ greatly in quality and quantity according to the extent and character of the association, as this has been established by cultivation, or is temporarily modified by bodily conditions.

Every one can easily perceive this to be true of the will of an idiot or a child, which is palpably a very different matter from that of a well-cultivated adult; and he must be very much blinded by metaphysical conceptions who fails to recognise the infinite variations in the power of will which any given individual exhibits at different times or in different relations. A person whose reproductive organs are of so defective a development as to be incapable of function lacks all the ideas, feelings, desires and will that are connected with those functions. When one of the higher senses is wanting in any one, he necessarily wants also the ideas, feelings, desires and will which arise out of the perceptions of that sense. The blind man cannot know the variety and beauty of colouring in nature, nor can he will in regard to those external relations which are revealed only through the sense of sight. Because, however, he knows not what he lacks, he does not consider his will inferior in quality, less complete, or less free. Were an additional sense conferred upon any one, it would doubtless soon teach him how much might yet be added to the will, how little his boasted freedom is, and might, perhaps, make him amazed that he should ever have thought himself free.

When is it that man is most persuaded that he speaks or acts with full freedom of will? When he is drunk, or

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an emotion. What are called "motives" to the "will" consist of our various sensations, appetites, and emotions, when subjected to the judgment of the understanding in deliberation. The "will," therefore, as a peculiar power, comes into existence only at the time of acting, by the combination and co-operation of its constituent elements.

mad, or is dreaming. It may be a reflection, then, worth dwelling upon, that man thinks himself most free when he is most a slave; but at any moment, in whatever mood he be, he would affirm that he is free. A person under the influence of alcohol judges very differently from what he does when in his sober senses, but is he in his own estimation less free at the time? Passion notoriously perverts the judgment, warping it this way or that; but will any appeal to the man who is in a passion elicit from him a confession that he is not acting with perfect liberty? Place the very same arguments before a man when he is elated by some joyous, or depressed by some grievous event; when he is in the full flow of vigorous health, or when he is prostrate on the bed of sickness or of death, and how different would be his judgment upon them and his will in relation to them: but whatever others may think of him, he will hold for certain the conclusion of the moment, just as a man in his sleep is fully persuaded of the reality of his dreams. While the looker-on who has had great experience among insane persons can often predict how a madman will act under certain circumstances, with as much certainty as he can predict an event conformable to a known law of nature,—who thinks himself so free as does the madman?

Whence comes this false opinion? It arises plainly from the cause which has already been pointed out: that consciousness reveals the particular state of mind of the moment, but does not reveal the long series of causes on which it depends. It is a deliberate fooling of one's self to say that actions depend upon the will, and then not to ask upon what the will depends. It is as though, says Leibnitz, the needle should take pleasure in moving towards the pole, not perceiving the insensible motions of the magnetic matter on which it depends.*

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* Speaking of a stone, which he supposes to have a certain amount of motion communicated to it by an impulse from without,

As in nature we pass from event to cause, and from this cause again to an antecedent one, and so on till we are driven to a first cause, so, in the sincere observation of the mind, we see that it is determined to will this or that by a cause or motive, which again is determined by another, this again by another, and so on till we have gone through the whole series of desires, aversions, hopes and fears—the sum of which is deliberation—that have preceded the last desire or aversion which we call an act of will. Those who fondly think they act with free will, says Spinoza, dream with their eyes open.

Now, if the final reaction after deliberation, which we call will, is, like other modes of reaction of nerve element previously described, a resultant of a certain molecular change in a definitely constituted nervous centre, then all the *design* exhibited in any given act of will must, like the design displayed in the function of the spinal cells, or the cells of the sensori-motor centres, be a physical result of a particular and intimate constitution or organization of nervous matter. In other words, the act of will which is the final expression of a process of reflection must needs contain a conception of the end desired—such a conception as has been determined by the nature of the reflection; the conception of the re-

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and which will necessarily advance through the motion imparted, Spinoza says: "Supposing the stone, as it proceeds in its motion, to think and to know that it is striving, in so far as it can, to continue in motion; inasmuch as it is only conscious of its endeavour and by no means of its passiveness, it will believe itself perfectly free, and conclude that it perseveres in its motion from no other cause than that it wills to do so. And this is that freedom precisely of which all boast themselves possessed, but which consists in this alone, that men are conscious of their desires, but are ignorant of the causes by which these are determined."—*Spinoza's Life, Correspondence and Ethics.* By R. Willis, M.D., p. 143. A falling stone, if conscious, would doubtless believe that it was, by its will, pulling the earth, though ever so little, towards it.

sult, or the design, in the act of will constituting, in fact, the essential character of the particular volition. In order that desire may became voluntary action for its gratification, a consciousness of the result of the action is necessary—that is, a conception of the aim of it. The desire, therefore, gives the special impulse which is directed or regulated by reflection, and the particular act of will is not the *determining* agent, but is the result *determined* by the impulse acting in conformity with the conception of the aim to be attained. The *design*, then, which a looker-on discovers in any act of will—and, be it remembered, there is no actual volition apart from the particular volition—will depend upon the nature of the individual whom he is observing, as that nature has been inherited, and subsequently developed by the experience of life.

The idiocy of any one, or his congenital inability to adapt himself to external relations by correspondences of internal cerebral reaction, is a physical fact: there is no design in many of the idiot's conscious acts, because such quality or property has not been built up by cultivation as a faculty of the supreme nervous centres, a congenital defect of constitution having made such organization impossible; in other words, the idiot is, by defect of nature, incapacitated from acquiring reflection, and cannot, therefore, have in his mind the conception of a result to be attained, cannot display conscious design. But the design manifest in any voluntary act of the best cultivated mind is likewise physical necessity: in consequence of reacting cerebral adaptations to the varieties of external impressions, reflection has, as already set forth, been organized as a development of the supreme nervous centres, or, in other words, as a faculty of the mind; and according to the extent and kind of the reflection will be the completeness of the conception of the end to be attained, or the degree of design discoverable in any act of will. The particular volition and whatever it contains, whether of folly or design, is a product of the organized residua of all former like volitions, excited into activity by the appropriate stimulus. For volitions, like sensations and ideas, leave behind them their residua which are organized in the nerve centres, and thus render future volitions of a like kind more easy. In this sense only are we warranted in speaking of *abstract* volition.

It may be thought that too much has been said of the question of design, but it has been necessary to lay stress upon it, because mistaken notions with regard to it appear to have been at the bottom of much error in philosophy. The design manifest in a mental act has been supposed to evince a power which transcended or anticipated experience, instead of one which actually conforms in its genesis to experience; and the spiritual conception of will as a fixed and undecomposable entity, in which was no variableness nor the shadow of a turning, is greatly indebted for its origin to that error. The metaphysical doctrine of final causes, which Bacon, Comte, Spinoza, Descartes, and others scarcely less great, all agree to have done so much harm in philosophy, has sprung from erroneous views of the nature of design. Instead of patiently searching out effects in nature through observation and experiment, men persisted for a long time in anticipating nature by divining ends or purposes according to the measure of their own imperfect experiences, and so prevented progress by setting up these theories to bar the paths of exact investigation. Supposing that the argument from design as to the existence of will as a metaphysical entity were pressed to its logical consequences, what must be the result? Nothing less than this,—that the animal, with its marvellous instinct of instant adaptation to the most complex and unfamiliar conditions, is possessed of a higher immaterial principle than the helpless child or the erring adult. We know right well, however, that the instinct of the animal is sometimes positively traceable to the acquired power of former generations; that it has been observably built up in the constitution of the nervous centres, as habit is daily formed in the individual, and transmitted to succeeding generations as an innate endowment. It is exactly the same with the design which is formed within the term of an individual life, and which ever testifies to the previous cultivation of the individual; the more cultivated the mind and the more varied the experience, the better developed is the will and the stronger its co-ordinating power over the thoughts, feelings, and actions; not otherwise, in truth, than as the co-ordinate reflex action of the spinal cord is developed by experience and culture. Design, therefore, when its nature is fairly analysed, so far from tending to make the will a fixed metaphysical entity, goes really to prove that the will is an insensibly organized result, and of varying value, quantitative and qualitative.

Having now adduced sufficient reasons to prove that the will is not a self-generating, self-sufficing force of constant quantity; but, on the contrary, a force varying in quantity and quality, and, like every other natural force, determined by antecedent causes, I may proceed to consider what power it actually has in our mental and bodily life. It is manifestly ordained that will, as the highest mode of energy of nerve element, and, when at its best, the supreme co-ordination of all the complex energies of body and mind, should control the inferior modes of energy by operating downwards upon their subordinate centres: the anatomical disposition of the nervous system is in conformity with what psychological observation teaches. But the undoubted fact that the will of a man can and does control inferior functions has led to a very extravagant and ill founded notion as to its autocratic power; and it must be allowed that not a little windy nonsense has been written concerning its authority. Assuredly it is no irresponsible despot in any mind, but is ever most obedient where it has most power; it conquers by obeying. Let us, then, consider what the power of the will is (1) over the movements, and (2) over mental operations, the two departments in which its rule is felt.

1. (*a*) The will has no power whatever over certain movements that are essential to the continuance of life. Not only do such motions as those of the heart and the intestines go on without any co-operation of the will and in spite of any intervention on its part, but movements that are only microscopically visible, such as the contractions of the small arteries, which are of so great importance in nutrition, are not under its direct influence. Nature has been far too prudent to rely upon such an uncertain and comparatively late appearing force for the movements essential to the continuance of life, or to admit its capricious interference: let a man try to asphyxiate himself by voluntarily preventing the respiratory movements, and he will learn a lesson as to the impotence of will which he might usefully remember when studying mental phenomena. I say nothing here of those insensible molecular movements of the physiological elements which, like thermal oscillations, are yet impenetrable to sense, but which are undoubtedly at the foundation of all visible vital actions.

(*b*) The will has no power to effect movements that are confessedly voluntary, until they have been very carefully acquired by practice. Every one knows that the theory of a particular skill of movement is a very different matter from the practice of it, and that the complete capacity of performance is gained, not simply by desiring and willing it, but by patient exercise and cultivation; the faculty of the movement is thus gradually organized in the proper nervous centre. A special and complex act, never hitherto attempted, will be as little likely to be done in obedience to the commands of the so-called "autocrat of the mind" as an act of flying.* When volition has been trained to the greatest perfection it becomes automatic: we never do a thing well until we have learnt to do it without thinking about it; and when we have reached this ease and skill of execution, if perchance our conscious attention is aroused, the chances are that we boggle and do badly. It is the unconscious element, inborn in the nature of the individual, or acquired as automatic power through the influence of education and experience, that constitutes the basis of character and conduct.

(*c*) When the will does dictate a movement, it is the *event* which is determined; it sets free, so to speak, the movement which has been organized in the motor nerve centre; there is no direct volitional control over the means by which the result is accomplished; so that it may even happen, and does sometimes happen, that in a man struck with a palsy of his limbs the will, all unaware of its impotence, commands a result which never takes place. Questionless, some would still not shrink, in face of such an experience, from affirming that consciousness never deceives. When the will dictates a certain event, its power is propagated, first through certain nerves, and then through them to certain muscles, in a manner of which we have no consciousness whatever: all we do know is, that if we wish to select a certain muscle and to put it singly in action, we have not the power to do so, and that, if certain movements have been habitually associated, it is a very hard matter to dissociate them; a thing which a simple effort of the will certainly will not do, but which a disease like chorea will sometimes do in spite of the will. Moreover, the will cannot determine a motor event unless the acting muscles are guided by sense; wherefore persons born deaf who have been taught speech are not able to modulate their voices, but speak in a loud, harsh, monotonous tone, not having the sense of sound to guide them to practise the proper motor adaptations, and so to acquire the requisite delicacy and flexibility of movements.

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* "We know how slowly the child acquires the power of so balancing his body as to hold it erect." . . . . "We observe how slowly the child learns to perform, with the requisite precision, the contractions on which the operation of walking depends." . . . . "There is another very familiar instance, that of learning to write."—J. MILL, *Analysis of the Human Mind*, pp. 271—273.

2. The extent of voluntary power over the mental operations is not nearly so great as is commonly assumed; much the same thing happening here as in its influence over movements. It will not be difficult to understand how this should be so, if we reflect that the immediate action of the will, even when dictating movements, is not upon muscles, but upon the motor grey nuclei or nervous centres of movement; that in both cases, therefore, the immediate operation is alike upon ganglionic cells, which are, in the one case, the associated centres of ideas, in the other, the associated centres of movements.(3)

(*a*) As the formation of our ideas takes place gradually through experience, and as the association between ideas is also organized in accordance with experience, both processes being based in the organic life and beyond the domain of consciousness, it is plain that the will does not determine either the material of thought or the laws of the interworking of ideas: it must accept as accomplished facts, as organized results, the ideas and the manner of their association. As with movements, so here, the will has no control over the means by which it works; it cannot dissociate firmly established connections, nor can it determine a new train of ideas without the first link of it being in the thoughts; and when the first link, however originated, is, so to speak, grasped, the train of ideas initiated is not irregular and alterable at will, but definite, in stern accordance with an order and system previously established by cultivation.* It is true that as it is with the power of will over movements, so it is with its power over mental states; it is a power which may be greatly enlarged and increased by exercise and cultivation. While some persons seem quite unable to regulate the associations of their ideas, and to hold their attention to a subject so as to pursue a consecutive reflection, others are distinguished by the mastery which they have over the subject and course of their thoughts, and by their powers of dismissing what is frivolous or irrelevant, and of adhering singly and steadily to the matter on which the mind is employed. The will, however, always presupposes definite and fixed series of ideas formed in the mind, series in which, without individual co-operation, one idea must definitely and of necessity follow another as one wave necessarily produces another as itself disappears.

There is an order or a necessity in the mental organization of a sane person, then, reflecting the order or necessity in the co-existence and succession of events in external nature; and the will can as little control the fundamental laws of the one as it can those of the other. The discovery of a new fact or law in the operations of nature by the man of science, or of a new beauty in nature by the artist or the poet, is merely an instance of a new and more exact internal adjustment to external circumstances; it is the evolution, as it were, of a new organ of sensibility and reaction to new relations; and when the connection between the action from without and the adapted reaction from within has been definitely organized in the brain, it is a belief. Certainly will is not absolutely powerless in the mind, any more than it is absolutely powerless in nature; for by recognition of the laws which govern mental development we can so arrange the conditions of their operations as to produce secondarily considerable modification of effects; and it may thus avail itself of these laws for its own profit, using their power in an enlightened manner to aid its development. In the one case as in the other it conquers only by obeying; true liberty, as Milton expresses it—

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* "Deliberation and investigation are like the hunting of a hound; he moves and sniffs about by his own activity, but the scent he finds is not laid, nor the trail he follows drawn, by himself. The mind only begins a train of thinking, or keeps it in one particular track, but the thoughts introduce one another successively . . . . which shows they have a motion of their own independent of the mind, and which they do not derive from its action, nor will lay aside upon its command."—TUCKER'S *Light of Nature*, vol. i. p. 14.

> "Always with right reason dwells
> Twinn'd, and from her hath no dividual being."

(*b*) Thus we come to a second consideration in regard to the power of the will: it is that those who unwarrantably exalt it derive their arguments entirely from the self-consciousness of a well-cultivated mind, neglecting altogether the instances of its simplest manifestations. It is bare justice to insist upon a reference to the earlier stages of development of cultivated mind, or to mind in its least cultivated state, as offering the simplest and most favourable instances for the formation of a sound induction. Will any one be so bold as to maintain that the young child or the idiot has volitional control over such thoughts as it has? Is any one so ignorant of the genesis of mind as to uphold the existence of true volition in the earliest stages of mental development? The child notably lives in the present, and its actions are direct reactions to the feelings and ideas that are excited in its mind.

(*c*) But as the individual cannot originate voluntarily an idea or a train of thought in the mind, so likewise he is unable sometimes to dismiss one notwithstanding an earnest will to do so. A painful idea will, as every one's experience must have taught him, return again and again into consciousness in defiance of every effort of the will to get rid of it, just as a movement may take place in spite of the will. The command which any one has over his thoughts is very different at different times, and one person may be able to dismiss a troublesome reflection when another cannot for the life of him put it aside; and when he does so dismiss it, it is not any abstract will, but he, the individual, who does it. We can give no exact reasons for these variations; the causes of them lie deeper than consciousness can reach or will control. Those who are able to conceive the notion of a self-determining will, or are content with a vague and confused mental state which they allow to pass for definite conception, maintain that the will shows its autocratic power by holding the attention to a motive until it has magnified it into the strongest motive, and by then electing to obey it. But they do not tell us what is the relation of this undetermined and determining agency to brain and character, or how it comes to pass that, notwithstanding its freedom and independence, it depends upon cerebral conditions, and is uniformly the expression of character and circumstances.

So far from will being autocratic, it is manifestly at the mercy of unknown conditions which may seriously affect at any moment its power or energy. Moreover, when an unwelcome idea is dismissed from the mind, it is not done by a simple despotic order of the will; but by fixing attention on some other idea which arises, by maintaining the tension of it, the latter is made consciousness; and inasmuch as two ideas cannot exist in consciousness at the same time, or at any rate cannot co-exist in equal intensity, that implies the dismissal of the former idea into the background and the initiation of a new current of reflection; a current which, however, is not uncommonly interrupted by the irruption of the old idea which refuses to become latent or dormant. Volitional control exercised over the thoughts manifestly presupposes the existence of many ideas in the mind, and the possibility of some of these latent ones arising to influence those that may be active. What power it is by which one idea calls up another we do not know, but we do know that it is not by the will.

Locke is admitted to have made a great advance in psychology when he demonstrated that there were no innate ideas in the mind, but that all its ideas were acquired by observation and reflection. The necessary consequence of his demonstration plainly is, what the foregoing considerations have shown, that there is no inborn will in the human mind. Let those who think otherwise endeavour to fix that period in the child's mental development when volition can be affirmed to have distinctly manifested itself. Whence and when the first volition comes would indeed be perplexing questions if the will were admitted to be a special faculty of the mind, distinct from other faculties, of constant quality, and never falling below a certain level of energy. We are powerless to fix the time of the first volition, because the will is not *one* and constant, but infinitely variable in quantity and quality, having many nervous centres, and not having any existence apart from the concrete act. There are in reality as many centres of volitional reaction in the brain as there are centres of idea, and the operations of volition depend as certainly upon modifications of cerebral substrata as do the operations of ideation and sensation. To assume *one* constant will is but a part of that metaphysical system of making abstractions into entities by which also is made *one* understanding, *one* reason, and the mental functions are mischievously parcelled out into distinct faculties that have no existence in nature.

It is utterly at variance both with psychological analysis of the nature of will, and with physiological observation of the constitution of the supreme nervous centres, to assume a single nervous centre from which will proceeds; if we must make a definite statement on so obscure a matter, it is that every current of idea may be a current of voluntary reaction. Let the active idea be attended by its sympathetic feeling, and the enlightened desire is volition. For consider this: although we describe the effect as ideo-motor when an idea reacts directly outwards, yet if the energy of the idea is not instantly so expended, but persists in the mind for a moment, and displays relations to other ideas, so as to produce a clearer consciousness of it before passing outwards into act, and especially if there is some feeling or desire attending it, then, when it does pass outwards, we commonly describe the effect as volitional. As consciousness and desire may, however, exist in every degree of intensity, it is plain that we cannot definitely fix a stage at which ideational reaction may be supposed to become volitional, nor determine the nature of the change which then ensues. Volitional action is fundamentally a reflex or excito-motor process in which a cerebral mechanism of extreme delicacy and intricate complexity of construction, embodying past experiences in its structure, intervenes between the ingoing stimulus and the outgoing movement; it is, if I may use such an ungainly compound term, a complex afferent-cerebro-efferent process. A volition or ideo-motor process which, though active in the brain, stops short of expression in actual movement, or in the inhibition of movement, is a belief: it is a certain internal experience which we feel and know can become a certain external experience, if necessary. "The will and the intelligence are one and the same thing," was the corollary of Spinoza from his close reasoning.

Let us imagine the first appearing idea in the infant's mind to react outwards, and to leave, as it will do, its after-effect in the nervous centre: when the idea occurs again, there will be a tendency to a similar reaction. Suppose, however, that the action causes pain to the child, and that thereupon a second idea is formed in its mind, the energy of which is opposed to that of the first. When the first idea recurs, it will, instead of passing outwards at once, excite into activity the second idea, which is inhibitory or preventive.* That is the simplest case of volition: the child has voluntarily refrained from doing something, or has voluntarily done something else, having gained by its experience a *belief* that the act which it foregoes would be painful; and the impulse that prompted the choice was not any abstract power, but sprang from that fundamental property of organic element by which what is agreeable is sought, what is painful is shunned. Bear in mind, when weighing volition, that there is often more power demanded for preventing or inhibiting action than for producing it. As ideas multiply in the mind, and groups or series of ideas are associated, of course the process becomes more and more complicated; the residua of volitions, like the residua of sensations or ideas, remain in the mind and render future volitions of a like kind more easy and more definite; *abstract* or *general* volitions, as it were, are formed as the representatives of certain trains or groups of ideas, or as the expression of their due co-ordinate activity; and by their persistence in the mind, when not in consciousness, and their interaction there, the character of our thought, feeling, and action is modified in a way which we cannot comprehend. Every one must have felt that an act which was at first disagreeable and demanded a painful effort of will may become, in fact invariably does become, after several repetitions, much less disagreeable or even an easy habit. Not only, however, does that particular act lose its painful qualities, but all acts of a like kind or of the same genus are made easier; and our manner of feeling with regard to them, and even our judgment concerning them, are greatly modified. Though we can give no explanation of the way in which we are aided by the traces of past volitions, it is plain enough that we are so aided; conscious acquisition becomes unconscious power; by an organic assimilation of some kind, even the will becomes automatic in certain relations.

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* This inhibition in the highest nerve-centres is just as mechanical as that which we have seen to take place in the spinal cord, and does not betray any more mysterious agency in the one case than in the other. In the complex organised union of nerve-centres one has the power, when excited, either of discharging or of inhibiting the activity of another centre: it is a common physiological function of nerve-centres, and what we call volition is the subjective aspect of it as it takes place in the supreme cerebral centres.

I suppose that if man could ever succeed in attaining to a perfect harmony with environing nature—including in that word the nature of men and things around him—so as to perceive and act in all relations with the unreflecting certainty and precision of instinct, he would have neither memory, nor reason, nor feeling, nor will, all which imply a persistence of the mental excitation in consciousness, but would act with the automatic regularity, precision and certainty of a perfect machine. For what are these functions? *Memory* is the conscious recalling of former experiences for the purpose of comparison; *feeling* the pleasing or painful character of experiences; *reason* the deliberate weighing of them—whence are deliberation and hesitation in consciousness; and *will* the conscious impulse at the end of deliberation. *Ideas* are, on the efferent or motor side, nascent movements—that is, intuitions of such movements as have been performed; on the afferent or sensory side, they are images of the sensory impressions which have been experienced, the revival of such sensory impressions on the occasion of a suitable external stimulus being *perception*. Plainly, then, none of these conscious functions—neither memory, nor feeling, nor reason, nor will, would be necessary or be displayed if the complete harmony imagined were realised.

These conclusions may then be distinctly formulated from the foregoing considerations: first, that wherever an afferent nerve passes to a cell or group of cells in the cortical layers of the hemispheres, and an efferent nerve issues from the cell or group of cells, there is the possible or actual centre of a particular volition; and, secondly, that volition or will, used in its general or abstract sense, does not denote any actual entity which existed anterior to experience, but simply expresses the due co-ordinate activity of the supreme centres of mental force, not otherwise than as the co-ordinate activity of the spinal cord or medulla oblongata might be said to represent its will—the faculty in both cases being commonly an acquired one in man. Consequently there is no normal volitional power in the abstract; that is the normal power which each person develops for himself by intelligent exercise; and that will be the most perfect volition in any case which expresses the most perfect consensus of all the energies, mental and bodily, of a healthy organism. When an animal acts in answer to some stimulus with direct and definite purpose, or, as we are in the habit of saying, instinctively, it does so by virtue of an endowment of its nerve centres which is original in it; but in the formation of human volition we observe the power of intelligent action in gradual process of acquirement—we witness an illustration of design in the making; and if we only go far enough back through generations, the acquisition by the animals may sometimes be traced. It would belie observation less to place an ideal entity behind the innate instinctive impulse of the animal than behind the gradually fashioned will of man.

To the fullest action of will in an individual two conditions are obviously necessary: first, an unimpeded association of ideas, whereby one conception may readily call up another, and complete deliberation ensue; and, secondly, a strong personality or character to give the decision between conflicting ideas and desires. I shall say something of the second condition first.

The strong or well-formed character which a well-fashioned will implies is the result of a good training applied to a well constituted original nature; and the character is not directly determined by the will, but in any particular act directly determines the will.* Character in truth settles not only what a person shall feel and do, but even what he shall think and believe, as it must needs do seeing that feeling and action lie deeper than thought and belief. Men are in some sort predestined by temperament to be spiritualists or materialists, orthodox or heretic, Evangelicals, Calvinists, Swedenborgians and the like. They are not moved by argument, discussion only feeding conviction; wherefore it is that abstract questions, which are of no real moment, are contested with the greatest heat and acrimony, and without altering belief one jot. A man cannot think truly, cannot realise in belief, that which his character cannot assimilate, any more than the string of a harp can respond to a note which is not its own, and is honestly astonished that others cannot be brought to see things as he sees them: his range of thought and belief is conditioned by his inherited ancestral and his acquired substrata. It is not argument addressed to the understanding, not the dry light of knowledge, which brings about reform in belief; when a changed feeling has been engendered through an unconscious modification of temperament, either in the individual or through generations, the reform takes place, as a crystal forms in a saturated solution; the conclusions of reason are accepted when the premisses are already embodied in the character or temperament. The conscious is but a superficial wave moving over the silent depths of the unconscious.

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* Common language, Tucker observes, implies two wills or more, opposing, impeding, restraining, and mastering one another; when an inordinate passion interferes with the prosecution of some design, we still regard it as a voluntary result, because sensible of the instigation. "But if we listen to the common discourses of mankind, we shall find them speaking of several wills, several agents, in the same person, resisting, counteracting, overpowering, and controlling one another; hence the so usual expressions of the spiritual and carnal wills, of the man and the beast, of self-will and reason, of denying our wills, subduing our passions, or being enslaved by them, of acting unwillingly or against the will, and the like. All which takes rise from a metonyme of the cause for the effect; for our actions being constantly determined either by the decisions of our judgment, or solicitations of our desires, we mistake them for the will itself; nor is it a little confirmation of the will being actuated by motives, to find them so intimately connected therewith, that a common eye cannot distinguish them apart."—*Light of Nature*, i. 547.

The way in which the will operates upon the character, or affects the *ego*, is indirectly by determining the circumstances which subsequently gradually modify it; we may place ourselves voluntarily in certain conditions of life or submit ourselves to certain influences, but all the energy of the strongest will cannot then prevent some degree of modification of character by them—cannot prevent an equilibration taking place. In any future act of will the altered character, or acquired nature, is expressed; and while we, perhaps, all unaware of any change, strenuously uphold our constancy, a looker-on clearly perceives the difference.* What we by a mental abstraction call the

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* The quantity of effect produced upon character in the interaction between the individual and the medium in which he lives will differ

ego, is in reality a combination in which are contained the residua of all former feelings, thoughts and volitions,—a combination which is continually changing and becoming more and more complex. That it differs at different times of life, and in consequence of different external relations, those who uphold most zealously its so-called identity do unconsciously admit when they acknowledge that, by religious influence or otherwise, any one may be made "quite another man," may be "converted," or be "regenerate." The will of Saul of Tarsus was not the will of Paul the apostle to the Gentiles.

The conversion may take place gradually in consequence of the steady operation of suitable outer influence, or it may sometimes take place suddenly after a great cerebral shock, of epileptic or other nature. Whosoever reflects upon his past life must look back upon scenes and events in it which stand so far apart from his present

much in different cases. The character exhibits a life of its own, tending to its own development independently of the medium, of such potency in some instances that it makes circumstances conform to it rather than conforms to them, but in other instances so feeble that it is lost in the medium. We may compare the effect to what happens in certain experiments on organic nutrition and absorption. Bone is known to be formed by the cells of the internal layer of the periosteum. M. Ollier proved by experiments the autonomy of these elements: he took a portion of the periosteum with its internal layer of young cells and transplanted it to a part of the body where there was no bone—into the neck or under the skin of the back. The piece developed there and produced a bony formation. The elements thus exhibited a life of their own independent of the medium in which they were born and in which they were placed. But the influence of the medium was shown in their ulterior lot, for M. Phillipeaux observed that the new bone disappeared after a time, being absorbed. The proper activity of the elements yielded to the influence of the medium. M. Ranvier removed a metatarsal bone of a very young animal and grafted it under the skin of the back. It grew at first, but after a time was absorbed. At the same time a new metatarsal bone was formed in place of the one which had been removed.

personality that they seem almost as alien from him as if they had happened to some one else; he may feel a difficulty in realising that his present *ego* was concerned in them. Memory brings them back, but with very much of the feeling of fading reality which attaches to dreams that are past, the *ego* of them being so different from the *ego* of now. When the *ego* is transformed in correspondence with changed external circumstances, the changes are so gradual as to be imperceptible at the time; but a rapid transformation of the *ego* may sometimes be effected by a great event, internal or external,—as, for example, when, at the development of puberty, new ideas and impulses penetrate the old circle of thought, and become constituent parts of it, producing no little subjective disturbance until the assimilation is completed and an equilibrium established. When a great and sudden revolution in the *ego* is produced by an external cause, it is full of hazard to the mental stability of the individual, and very apt to become pathological: nothing is more perilous to the equilibrium of a character than for any one to be placed in entirely changed external circumstances without his inner life having been gradually adapted thereto; and madness, when its origin is fairly examined, always means discord between the individual and his circumstances.*

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* Dr. Channing, in a sermon *On the Evil of Sin*, speaking of the absurdity of the notion that in changing worlds there will be a change of character, says:—"In the first place, it contradicts all our experience of the nature and laws of the mind. There is nothing more striking in the mind than the connexion of its successive states. Our present knowledge, thoughts, feelings, characters, are the result of former impressions, passions, and pursuits. We are this moment what the past made us; and to suppose that, at death, the influences of our whole past course are to cease on our minds, and that a character is to spring up altogether at war with what has preceded it, is to suppose the most important law or principle of the mind to be violated, is to destroy all analogy between the present and future,

The history of a man is plainly the truest revelation of his character; for what he has done indicates what he has willed; what he has willed marks what he has thought and felt, or the character of his deliberations and feelings; what he has thought and felt has been the result of his nature then existing as the developmental product of a certain original construction and a definite life experience. Objectively considered, the identity of the *ego* is neither more nor less than the identity of the full-grown oak with the first slight shoot from the acorn: subjectively considered, the strong and sure conception which each one has of the *ego* is not surprising, inasmuch as it is the most frequently active idea, being concerned with more or less consciousness in every event of his life, being that to which every action has fundamental reference. The fashioning of the will is the fashioning of the character; and this can only be done indirectly by fasohining the circumstances which determine the manner of its formation. But, however formed, it is the character which determines what the inclination shall prompt as most desirable, the judgment decide to be most eligible, and the will carry into effect. If it were possible for any one to enter thoroughly into the inmost character of another person, and to become exactly acquainted with the moving springs of his conduct in his particular relations of life, it would be possible not only to predict his line of action on every occasion, but even to work him, free will notwithstanding, like an automaton, by playing on his predominant passions, interests, or principles.

Secondly, there is manifestly required for the free

and to substitute for experience the wildest dreams of fancy. In truth, such a sudden revolution in the character, as is here supposed, seems to destroy a man's identity. The individual thus transformed can hardly seem to himself or to others the same being. It is equivalent to the creation of a new soul."

action of will an unimpeded association of ideas, so that the due materials for the formation of a sound judgment may be available. But the ease, completeness, and character of such association depend, as already shown, on the condition of the nervous element, very slight disorders of which accordingly quickly declare themselves in a deterioration of the will. The person who has long addicted himself to alcoholic excesses, or to the habitual use of opium, or to some other pernicious vices, initiates a degeneration in the intimate elements of nervous structure, which, though we cannot yet detect its nature by microscopic observation, declares itself distinctly in a deterioration of moral sense and a pitiful enervation of will; and if the degeneration increase, the further depravation of will is shown by the loss of co-ordination of mental functions. As the secondary automatic faculties of the spinal centres soon suffer from any disorder of nerve element, and reveal their suffering in the loss of co-ordinate power over the movements, so in the loss of co-ordinating power over the ideas and feelings, in their irregular and independent reactions, is revealed the deterioration of the will. And as, when the disorder of the spinal centres is still greater, all co-ordination is lost and convulsions ensue; so in the supreme ganglionic cells of the hemispheres, when the disturbance is great, there is no co-ordination of the thoughts and feelings, convulsive reactions of the cells take place, and the individual is a raving lunatic, or a dangerous one dominated by a few persistent morbid ideas. Volition is, as it were, resolved into the inferior constituents out of which it is in the due course of things compounded, as a ray of white light may be decomposed into several coloured rays; and in place of the definite, calm, co-ordinate activity of well-formed will, there is the aimless, irregular, explosive display of inferior activity. It is obvious, however, that even in the sound mind the quantity and quality of the volition depend upon the fulness of the reflection, and that any hindrance to the due association of ideas will *pro tanto* affect the will: if the particular volition were to be resolved by a retrograde metamorphosis into its component elements there would be an explication or unfolding of all the ideas and desires which had gone to form it; and going still further back in the analysis, there would be a revelation even of those particular relations in life which have helped to determine the individual's definite organization of ideas, the character of his *ego*.

It will be proper, before finishing with the consideration of the will, to say something more special concerning the relations of the emotions to it than I have done in pointing out that the dynamic impulse is derived from the affective life. If an active emotional idea reacts to its stimulus directly in outward action, as its tendency is, it so far weakens the will; duly controlled and coordinated in reflection, as is the case after a right mental cultivation, it strengthens the will. Before many ideas have been acquired, and their multitudinous associations fixed, as in the young child; or where the state of the development of the brain precludes intellectual development, as in the idiot and in the animal,—the emotions excited immediately expend their energy in outward manifestation; and when in the cultivated adult there exists, from some cause, an unstable condition of nerve element, or when the tension of the emotion or passion is exceedingly great, it will also react directly outwards in spite of the will: the law, admitting this, would count it therefore no great crime for a husband to kill a man whom he surprised in the act of adultery with his wife. But whosoever takes careful note of his own mental states may call to mind occasions on which a suddenly excited emotion prompted strongly a particular action, which he nevertheless withstood for an instant, and might, if necessary, have forborne altogether; but perceiving, with quick intuition, that he might do well to manifest the emotion, he afterwards allowed the action to take place. The looker-on, perhaps, sees only an impulse and rashness; and yet the rashness was in some sort deliberate—an indiscretion which served the end when wiser plots might have failed. Emotion was the real motive force, but it was emotion acting under the direction of reason, and, therefore, in accordance with prudent insight into the external relations. The individual might have done the same action in obedience to a calm resolution of the will, and better so, perhaps, if he had been operating upon inanimate objects; but in dealing with men it may sometimes be that a prudent exhibition of feeling much aids the success of the ends designed. Only let a man beware that, however he impose upon others, he deceive not himself by his passion, by allowing it to obscure his reason and pervert his judgment: restrained within the supreme centres, it is apt to do that in all minds, and sure to do so in weak minds; but, duly subordinated and co-ordinated in reflection, it adds force to resolution. Restrained passion, acting under the calm control of reason, is verily a most potent force; it gives a white heat, as it were, to the expression of thought, an intensity to the will.

An emotional person—who is literally an explosive person—certainly often produces great effects in the world, and especially such effects as are destructive of some existing system or belief; it is, indeed, commonly their great self-feeling that gives to the reformers their abandonment, energy, and consequent success. But an evil often outweighing these advantages is that there is no guarantee that they are right; for, necessarily one-sided, they see but a part of a truth—that part which affects their selfhood most keenly. The history of human labours and failures furnishes many examples which teach how a great principle has suffered seriously from the hasty, violent, and ill-considered action of its sincere and earnest advocates: adverse events or circumstances, which they in the torrent of their passion could not recognize, but which, as rational beings looking to the operation of causes, it behoved them to have recognized, have swept them away, and the truth which they upheld has been for a while the victim of their indiscretion. As in the mental phenomena of the individual the power of reflection is often best exhibited in the prevention of action prompted by feeling—in an inhibitory function; so amongst men in the social state the power of a good understanding is sometimes best shown by not pressing hotly forward an immature reform. But it is a very hard matter for a reformer who feels strongly to perceive that what is theoretically desirable and right may also practically be undesirable and wrong under existing social conditions; he is apt to treat adverse circumstances as if they were accidents or anomalies in nature, having no right of existence, and thus more or less wilfully shuts his eyes to the force of events on which he proposes to operate, and which will, in any case, operate upon his principle. He hurls a favourite principle, which may be a very just one, into the world not sufficiently prepared for it, not having reached the due level of its evolution, and which, therefore, is necessarily hostile to it; and if his truth is oppressed and seemingly extinguished by the opposition which it meets with, then he is disheartened and complains, or is angry and rails. However, it is not nature which is wrong, if there be any wrong, but himself—the reformer. The fact that he did not succeed proves that he did not deserve to succeed; he has not rightly estimated the character and weighed the force of circumstances which have been too strong for his truth, and by a simple law of nature have, for a time at least, quenched its light.

A great advance can never be superimposed upon people miraculously; in order to be genuine and lasting, it must be a natural evolution from pre-existing events—must grow out of them; and that which most effectually demolishes an old error is not a passionate attack upon it by the intensely feeling reformer, but a new and better creation, which quietly undermines it and takes its place. It is one good function of the conservative instinct in human nature, by withstanding change, to prevent reform taking place until the new has absorbed that which is good in the old—to constrain revolution to be evolution. Creation is a far higher order of work than destruction; it is the quiet, self-contained activity of definite productive aim—in other words, of will in its highest development—as opposed to the explosive and dissipated display of an inferior and mostly destructive emotional force. But as the calm intellectual contemplation of events, viewing all the relations of them, is attended with no great spur to any particular activity, but marks an equilibration between the individual and his environment, it is easy to understand how excellent a thing to put the will in active motion, in a particular case, is a passionate feeling or desire of good to be attained or of ill to be shunned, in order to establish an equilibration. Then the will, enlightened by an adequate reflection upon all the co-operating conditions, is able to act with a calm, steady, intelligent and potent energy. However, as emotion is strongly infectious, running like an epidemic sometimes through multitudes of people, it is impossible to foresee with certainty what effect the emotional man may or may not produce; he sometimes raises a storm of agitation which sweeps all before it, when reason looking calmly at the circumstances would prognosticate a fruitless labour.

The difference in quality and immediate energy between the will which is urged by strong desire and the will which proceeds from a calm and full reflection, is strikingly evident in the character of the work done by two kinds of reformers. Surveying the men who have exercised great effects on the progress of mankind in this capacity, they appear broadly divisible into two classes: the men of wide intellectual grasp, vast knowledge, serene feeling, and calm energy, and the men of limited vision, intense feeling, and impetuous energy—the extensive or many-sided, and the intensive or one-sided men. The former, taking a comprehensive survey of events, seeing in them the simple operations of natural law, recognizing the character and the import of existing relations, and the true value of the present question, which is often exaggerated by its immediate urgency, have their feelings subordinated to their reason, and do not abandon themselves to an unrestrained impetuosity. They may do great work, but they do it, not like lightning, rapidly and tumultuously, but like light, slowly, quietly, and silently; their work is constructive, not destructive; they are reformers of opinion rather than of practice; and the fertilizing influence of their thought is felt through many generations. The latter, on the other hand, are possessed with a conviction so tremulous with intense self-feeling that it seems the one important thing in the world, and they are more or less blind to everything else; they put all their energy into explosive action, which, like lightning, is destructive; they are iconoclasts who beat down furiously the idols that are worshipped in order to set up others in their places; they are reformers of practice rather than of thought; and though they often effect a great immediate practical result, they have little or no fertilizing influence upon the intellectual development of the future. The earnest desire which inspires their energy springs from a basis of strong self-feeling.

The most perfect display of will involves the full agreement of all the powers and dispositions of the mind, and is the expression of their complete co-operation. If there be any want of harmony between them, any feeling or thought which does not work in entire consent with the rest, holding back like a stubborn horse in a team, or inclining to deviate from the track like a wilful one, the act of will loses so much vigour thereby; it is no longer, as it were, the complete union of coloured rays into one ray of pure white light, but is partially broken up into dissentient forces. In postulating this complete harmony of the mental functions, we necessarily postulate at the same time that complete harmony of the bodily functions which is perfect health; so that the highest display of will is the expression of the most perfect health of mind and body. In order that the will on all occasions may reach, as near as possible, this height of excellence, it is obviously necessary that care should be taken to maintain the body in the best health, and so habitually to fashion the mental character in relation to the circumstances of life that it shall be itself a complete harmony; that on no occasion shall passion incline where the judgment approves not, or conflicting passions distract the mind, or inclination prompt what conscience condemns; that always the whole energies of being shall consent in the will.

Without doubt, will is the highest force which Nature has yet developed, the last consummate blossom of all her marvellous works. The natural product of desire illuminated by the highest and completest reflection, it represents the exquisitely and subtly adapted reaction of man to the best insight into the relations in which he moves. Hence the vast power of the human will witnessed in the lives of those eminent men of practical genius who have exhibited its highest evolution. They were in harmony with the current of events among which they lived; co-ordinating in themselves the forces that were at work around them, they accomplished what the world had at heart in that age. Thus the force which they displayed was a force not their own; the power of the universe was behind them, and they became the organs of its manifestation. Beneath them were "the everlasting arms." If we reflect upon the way in which the social and intellectual forces of an age are thus co-ordinated in the work of genius, and again upon the manner in which the actions of the different nerve-centres of the body are subordinated and co-ordinated in the manifestation of will,—how there are, as it were, in both cases, a gathering together and a concentration of different forces into *one* definite mode of action, a unifying of their energies,—we may be able to form a conception, by help of what we can thus observe, of the mode of that exaltation or transpeciation of force and matter throughout nature which we cannot follow through its inmost processes.*

By the power of a well-fashioned will man reacts with intelligent success upon the external world, brings himself into a complete harmony with its surroundings, assimilates and incorporates nature, and thus carries forward its organic evolution: he realises practically that there are not two worlds, a world of physical nature and a world of human consciousness, standing over against one another, but that there is one world of nature whereof his conscious life is an event. The highest action of the will is therefore truly *creative*, for in it is initiated a new development of nature through man; it adumbrates the possibilities of mankind, as a rudimentary organ in a lower species of animal foretells obscurely the higher species in which it will have full development. If we ask whence comes the impulse which displays itself in this upward *nisus*, we can only answer lamely that it comes from the same unfathomable source as the impulse which inspires or moves organic evolution throughout nature. He who reflects upon himself and upon the universe is forced in the end to the recognition, in the workings of the world, of a power from which all life and energy proceed, which has been from the beginning, is now, and, so far as we can see, ever shall be, and which cannot be comprehended and controlled by human thought and will, but comprehends and controls human thought and will. We recognise an impulsion outside ourselves, working also in our wills, which is the moving energy of the evolution which went on through countless ages before man appeared upon earth, which is going on now in his progress, and which will doubtless go on through countless ages after he has ceased to replenish the earth and subdue it. We come back indeed to something which, however we name it, or forbear to name it, is very like the theological Trinity—God the Unrevealed and Unrevealable, God the Revealed, and God the Revealer. In human thought and will nature has arrived at self-consciousness, but the power which impels the highest evolution of life, as manifested in the highest reach of human thought and will, is fundamentally the same power as that which impels the evolution of the lowest forms of life. For man to seize upon this power as it works in him, to divorce it from the rest of nature, to look upon it as supernaturally infused and designate it free-will, and thereupon to base claims for himself not only to a rank infinitely higher than, and to a destiny entirely different from, that of anything else in the universe, but to be the end and purpose of creation, may be set down as a proof that nature, having reached self-consciousness, is, like a youth at the corresponding stage of development, afflicted with an insufferable conceit.

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* *Transpeciation* is a word used by Sir Thomas Browne which might be found useful at the present day.

NOTES.

[1] (*p.* 416).—Jonathan Edwards asserts that there is no difficulty in showing, by attention to our own experience, not only that the will must be influenced in its choice by something that has a preponderating influence upon it, but also *how it is so*:—

"Thus, supposing I have a chess-board before me; and because I am required by a superior, or desired by a friend, or to make some experiment concerning my own ability and liberty, or on some other consideration, I am determined to touch some one of the spots or squares on the board with my finger; not being limited or directed in the first proposal, or my own first purpose, which is general, to any one in particular; and there being nothing in the squares, in themselves considered, that recommends any one of all the sixty-four more than another; in this case my mind determines to give itself up to what is vulgarly called *accident*,[*] by determining to touch that square which happens to be most in view, which my eye is especially upon at that moment, or which happens to be most in my mind, or which I shall be directed to by some other such like accident. Here are several steps of the mind's proceeding (though all may be done as it were in a moment): the *first* step is its *general* determination that it will touch one of the squares. The *next* step is another *general* determination to give itself up to accident, in some certain way; as to touch that which shall be most in the eye or mind at that time, or to some other such like accident. The *third* and last step is a *particular* determination to touch a certain individual spot, even that square which, by that sort of accident the mind has pitched upon, has actually offered itself beyond others. Now it is apparent, that in none of these several steps does the mind proceed in absolute indifference, but in each of them is influenced by a preponderating inducement. So it is in the *first* step; the mind's general determination to touch one of the sixty-four spots: the mind is not absolutely indifferent whether it does so or no; it is induced to do it, for the sake of making some experiment, or by the desire of a friend, or some other motive that prevails. So it is in the *second* step; the mind's determining to give itself up to accident, by touching that which shall be most in the eye, or the idea of which shall be most prevalent in the mind, &c. The mind is not absolutely indifferent whether it proceeds by this rule or no; but chooses it because it appears at that time a convenient and requisite expedient in order to fulfil the general purpose aforesaid. And so it is in the *third* and last step; it is determining to touch that individual spot which actually does prevail in the mind's view. The mind is not indifferent concerning this; but is influenced by a prevailing inducement and reason; which is, that this is a prosecution of the preceding determination, which appeared requisite, and was fixed before in the second step. . . . .

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[*] I have elsewhere observed what that is which is vulgarly called *accident;* that it is nothing akin to the Arminian metaphysical notion of *contingence*, something not connected with any thing foregoing; but that it is something that comes to pass in the course of things, in some affair that men are concerned in, unforeseen, and not owing to their design.

"As the acts of will, in each step of the fore-mentioned procedure, do not come to pass without a particular cause, every act is owing to a prevailing inducement: so the accident, as I have called it, or that which happens in the unsearchable course of things, to which the mind yields itself, and by which it is guided, is not anything which comes to pass without a cause; and the mind, in being determined to be guided by it, is not determined by something that has no cause, any more than if it determined to be guided by a lot, or the casting of a die. For though the die's falling in such a manner be accidental to him that casts it, yet none will suppose that there is no cause why it falls as it does. The involuntary changes in the succession of our ideas, though the cause may not be observed, have as much a cause as the changeable motions of the motes that float in the air, or the continual, infinitely various, successive changes of the unevenness on the surface of the water." *An Inquiry into the Modern prevailing notions of that Freedom of the Will which is supposed to be essential to Moral Agency, Virtue and Vice, Reward and Punishment, Praise and Blame*, p. 67.

[2] (*p.* 427).—"Sixthly, the will appears to be nothing but a desire or aversion sufficiently strong to produce an action that is not automatic primarily or secondarily. At least it appears to me that the substitution of these words for the word *will* may be justified by the common use of language. The will is, therefore, that desire or aversion which is strongest for the present time. Since, therefore, all love and hatred, all desire and aversion, are factitious and generated by association, *i.e.* mechanically, it follows that the will is mechanical also." HARTLEY'S *Theory of the Human Mind*, p. 205.

"Appetite, therefore, and aversion are simply so called as long as they follow not deliberation. But if deliberation have gone before, then the last act of it, if it be appetite, is called *will;* if aversion, *unwillingness.* . . . . Neither is the freedom of willing or not willing greater in man than in other living creatures. For where there is appetite the entire cause of appetite hath preceded; and, consequently, the act of appetite could not choose but follow; that is, hath of necessity followed. And, therefore, such a liberty as is free from necessity is not to be found either in the will of men or of beasts. But if by liberty we understand the faculty or power, not of willing, but of doing what they will, then certainly that liberty is to be allowed to both, and both may equally have it, whensoever it is to be had."—*Hobbes*, vol. i. p. 409.

"The whole sum of desires, aversions, hopes, and fears, continued till the thing be either done or thought impossible, is that we call *Deliberation.*"—*Leviathan*, vii.

[3] (*p.* 436).—I extract the following remarks of Hume:—

1. "But do we pretend to be acquainted with the nature of the human soul, and the nature of the idea, or the aptitude of one to produce the other? . . . . We only feel the event, namely, the existence of an idea, consequent to a command of the will. But the manner in which this operation is performed, the power by which it is produced, is entirely beyond our comprehension."

2. "The command of the mind over itself is limited as well as its command over the body; and these limits are not known by reason. . . . . Will any one pretend to assign the ultimate reason of these boundaries, or show why the power is deficient in one case, not in another?"

3. "Self-command is very different at different times. . . . . Can we give any reason for these variations, except experience? Is there not here, either in a spiritual or material substance, or both, some secret mechanism or structure of parts, upon which the effect depends, and which, being entirely unknown to us, renders the power or energy of the will equally unknown and incomprehensible?"

4. "The motion of our body follows upon the command of our will. Of this we are every moment conscious. But the means by which this is effected, the energy by which the will performs so extraordinary an operation; of this we are so far from being immediately conscious, that it must for ever escape our most diligent inquiry."

After explaining that volition does not act directly on a limb itself, but through certain muscles and nerves, through which the motion is successively propagated, he asks—"Can there be a more certain proof that the power by which this whole operation is performed, so far from being directly and fully known by an inward sentiment or consciousness, is to the last degree mysterious and unintelligible. Here the mind wills a certain event; immediately another event unknown to ourselves, and totally different from the intended, is produced. This event produces another equally unknown; till, at last, through a long succession, the desired event is produced."—*Inquiry concerning the Human Understanding.*

CHAPTER VIII.

MOTOR NERVOUS CENTRES OR MOTORIUM COMMUNE, AND ACTUATION OR EFFECTION.

THUS far I have been engaged in considering the development of the mental organization, as it takes place in the production of simple or presentative ideas out of sensory impressions, with their associated motor reactions,—that is, in apprehension; in the production of representative ideas or conceptions by abstraction from the simple ideas,—that is, in comprehension; and in the production of volition as the result of the complex interworking of desires and conceptions. But it is not man's function in life merely to think and feel; his inner life he must express or utter in action of some kind. In all animals there is an instinct or impulse to perform movements, either spontaneously or in answer to conscious and unconscious stimuli; for bodily exercise is necessary to the procuring of food, to the preservation of health, and to defence against their enemies. When there is no exercise of the proper movements, sensations of discomfort and restlessness are produced which impel the animal to perform movements in order to obtain relief from the discomfort which is felt, and to procure the agreeable sensations which will follow activity. After exertion there is an instinct for repose; the energy stored up by nutrition in the nervous centres having been spent, and requiring renewal. The instincts to movements in the different organs with which animals are thus furnished to fulfil the ends of their life produce the habits and actions of their so-called animal life, and the movements are really complex manifestations of sensori-motor action. Just as centripetal and centrifugal nerve fibres united by nerve cells and commissural fibres are the simple elements out of which the complicated structure of the nervous system is built up, so sensation and motion are the simple functional units from which the complex mental processes are evolved. The natural consequence of a sensation is a movement, which follows necessarily, unless it be inhibited, or unless it be transformed into an equivalent activity, as happens when its energy is expended in acting upon the blood-vessels and affects secretion and nutrition.

It is evident then that there are other residua besides those which have already been specially dealt with, which enter as constituents into his mental life—the residua, namely, that are left behind by movements or actions. The movements that are instigated or actuated by a particular nerve centre do, like the ideas, leave behind them their residua, which, after several repetitions, become so completely organized into the nature of the nerve centre that the movements may henceforth be automatic. There is then, intervening between the volitional impulse and the action, a department or repository of motor residua, in which exist the immediate agents of movements—a region, psychologically speaking, of abstract, latent, or potential movements. If recourse be had to physiology, it is found that, conformably with what psychological analysis teaches, there are numerous special motor nervous centres, or nuclei of ganglionic cells, cerebral and spinal, from which motor nerves proceed, and by the experimental irritation of which movements may be artificially excited. These motor centres have their special connections, by means of internunciant fibres, with regions of the anterior convolutions of the brain, so that, as recent experiments have shown, the definite movements may be excited by stimulation of the cortical representatives. As the sovereign deals with his subjects through their representatives, so the will deals with movements through their representative centres in the convolutions. The term which I have taken leave to use for the purpose of designating, psychologically, the common centres of movement is the *motorium commune.*

This region of motor residua, or, as I have ventured to call it, this *motorium commune*, is related to conception on the reactive side of human life, as sensation is on the receptive side. As the residua of sensorial activity, as already seen, minister and are necessary to a definite representative conception, so the residua of motorial activity in their turn enter essentially into conception, and are indispensable to its realization in action. It may not be amiss, then, to take notice here, again, how the highest mental action comprehends or contains the whole bodily life. The sensory life enters essentially into conception; the organic life, as previously set forth, participates in the emotional quality of it; and the motorial activity of the body is essential to its exact definition and outward expression. How mischievously unjust, then, is the absolute barrier set up between mind and body! How misleading the parcelling out of the mind into separate faculties that answer to nothing in nature!

What name may most properly be given to this neglected but important motorial region of our mental life? The motor residua that mingle in our conceptions have been called, in Germany, *motor intuitions or percepts* (Bewegungs-anschauungen). This name is applicable only to those motor substrata that are concerned in voluntary movements—those the functions of which intervene between volitions and acts and which may be excited by stimulation of the cortical representative motor centres. But it must not be overlooked that the subordinate motor ganglia are the real motor centres, containing the organized faculties of the different movements, and that these may be excited to action by a sensational or reflex stimulus as well as by an impulse from the hemispheres. In this case it plainly would not be proper to speak of motor intuitions or percepts: it is only when the impression of the definite movement has been conveyed upwards to the frontal brain that the motor intuition is produced. The whole region of motor residua might be described generically as the department of *actuation;* a department containing the powers or faculties through which the nervous centres, when excited to activity, act upon the muscular system, and, by thus uttering or expressing their energies, restore the equilibrium between the individual and the environment. It contains the means by which will, idea, or sensation actuates definite movements, or prevents their occurrence. To give the name of *locomotive faculty* to this province of mind would land us in the inconsistency of denominating locomotive an agency which often acts to inhibit or prevent motion.

However it be named, there can be no doubt that such a region of mental activity exists, and that in it are contained, fashioned and co-ordinated, the faculties of different groups and series of movements. It is easy to perceive why will can only determine the *result* when it dictates an act, and cannot determine the action of a particular muscle, or the combined actions of certain muscles which have not acted together before. All it does is to let loose, as it were, the proper agency in the motor centre; and this is done by willing the event, which it is enabled to do by means of the proper motor intuition. When I will to utter a certain word, I will the event, the complex articulating movements being possible to me only through the medium of the proper motor intuition. The impulse *plus* the special motor intuition constitutes the particular volition. A voluntary movement is truly a reflex act in the cortical centres of the brain; differing from the lower reflex movements in these circumstances—first, that it does not immediately follow the stimulus, but is caused by the excitation of many associated sensory residua which have been laid up in consequence of former experiences; and, secondly, that it contains or evinces a distinct adaptation to an end or purpose, by reason of the excitation of associated motor residua which have been organized effects of former adjustments. If the result wished is a new, unfamiliar one, no residua thereof from previous experiences existing in the motor centres, then the will is unequal to the accomplishment of it; there is not an exact and definite idea of the end to be effected, the necessary motor intuition being wanting. After repeated trials, the desired skill is firmly acquired, and the movement is thenceforth automatic, the motor intuition having been gradually organized in the proper nervous centres: the result stored up strictly corresponds with that which in other nervous centres we describe as *abstract* idea. It is probable that the so-called motor centres in the cerebral convolutions are really the centres of these motor intuitions; in other words, they are the centres in which the subordinate motor centres act upon consciousness, and they thus constitute the physiological agency of voluntary movements.

In animals the motor intuitions, like their other faculties, are mostly innate. There are no distinct, clear conceptions accompanying their instinctive actions; but obscure sensations and feelings excite the motor centres, which then determine the action of the proper muscles. In man, on the other hand, although the faculties of certain co-ordinate movements do exist, preformed in the nervous centres, the motor faculties are mostly acquired; in this regard corresponding with the formation of his other mental faculties. Our ideas of distance, size, and solidity furnish striking examples of the manner in which we are indebted to our motor intuitions, and of the difference in respect of them between us and the animals. The young swallow's intuition of distance appears to be as perfect when it begins to fly as it is after a life-experience; but it is not so with the young child, which cannot for some time tell how distant or how near an object is. In the first instance, the child's body moves with the eyes, when these are fixed upon a light that is moved about before it. After a few weeks the moving light is followed by a motion of the head only; next the eye-ball itself is turned also; and ultimately objects are followed with the eye without any motion of the head. As this is going on, a recognition of the position and distance of an object is acquired gradually, and the convergence of the axes of the eyes is seen to change regularly and quickly with the approach of the object to, or its removal from, the eyes.

Now it is well known that the accommodation of the eyes to distance is effected, for near objects, by a convergence of their axes and an accommodation of their lenses, two actions which are from the first very firmly associated; so much so that a congenital defect in the lens is now recognised to be the frequent cause of squinting in children. And it is quite possible, by experimentally modifying, by the use of suitable glasses, the customary consentaneous convergence of the axes, to deceive perception and to cause it to be a false induction concerning the object. It infers certain things from certain movements, and when these are deranged it makes false inferences for a time. But these accommodating movements of the eye are not determined by any act of will, nor are they within consciousness; they are consensual movements in respondence to the visual sensation, and strictly comparable with the instinctive movements of the animals. It is not the visual sensation directly which gives us the idea of intuition of distance, but the motor intuition of the accommodating movement in association with the visual impression, which, though uncertain and confused at first in man, soon gets precision and distinctness. And, after all, it gets this precision and distinctness in so short a time only because it inherits an anatomical mechanism which represents the accumulated experiences of countless ancestors: if the individual were obliged to acquire it himself from the foundations, all his life would not suffice for the work.

In this example we have a type of that which happens, with greater or less rapidity, in the case of every movement in the body. The infant at first kicks out its leg—whether from a so-called spontaneous outburst of energy, or by reason of some organic or of some external stimulus, matters not—and bringing it in contact with some external object, gets thereby a sensation, in respondence to which, as in the consensual accommodation of the eyes, adaptations of movements take place, and muscular intuitions are more or less quickly and completely organized.* There is a fusion of different local sensations with different muscular feelings; certain sensations and certain movements are thus associated, and the residua of the muscular movements, or the motor intuitions, are henceforth essential constituents of our mental life, whether we are distinctly conscious of them or not.

Consider, if further illustration be needed, the gradual acquisition of the complex movements of speech, and the intimate connection which they have with the formation of our conceptions. We acquire articulate speech through imitation of the sounds of words; the sensory residua of the sound of the word are associated by practice with definite muscular articulating movements; the motor intuitions are thus organized in their proper centres; and these motor intuitions may then be excited, and give expression to ideas, by stimuli proceeding from the associated sensory residua of other senses than sound. Thus the sight, or touch, or taste of an object will excite the proper word without intervention of the auditory residua, when speech has been learned. A weak-minded person, or a person of low cultivation, often cannot content himself with the mental representation of a word, or clearly comprehend a question put to him, without bringing the actual movement to his assistance; he must utter the word or repeat the question aloud, in order to get his conception distinctly.

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* The innate mechanism soon comes into action, being in a state of waiting preparation, so to speak, to respond to the suitable stimulus. As Sir C. Bell remarked, an infant evinces an apprehension of falling while it is still in the nurse's arms. A young kitten will stretch its neck in search of the teat when it is only half born.

Education consists fundamentally in the association of certain definite sensory currents, excited by external impressions, with certain definite motor currents, which are the adapted reactions of the individual to the impressions which affect him. No wonder then that we find so much automatic action when we look closely into the mental processes of men; the whole aim of education on the part of one generation being to produce upon the next generation the same impressions which it has experienced, and to teach the same reactions which it has performed. It is most necessary, however, to guard against the strong disposition which there is to look upon certain movements, those of the eye and the tongue, as having a special connection with the mental life which other movements of the body have not; they have a specially intimate connection, but not a special kind of connection. Unwarrantably separating by an absolute barrier the mind from the body, and then locating it in a particular corner of the latter, as is commonly done, we are prone to forget that in mental action the whole bodily life is comprehended—that what is displayed outwardly exists in the innermost—that every motor intuition has its essential place and influence in our mental life.

It is not without instruction to note how very far the limit of possible utterance by speech is from being reached. Of the possible sounds which man is able to pronounce and distinguish a great variety is never made use of. "Each language or dialect of the world is found in practice to select a limited series of definite vowels and consonants, keeping with tolerable exactness to each, and choosing what may be called its phonetic alphabet." * In the different languages of the world there is an abundant variety of sounds, many of which are now used to express the same ideas, but which might, if need were, be used at some future time to express the new ideas and feelings which mankind will presumably acquire. Moreover, as Mr. Tylor has remarked, there are many sounds capable of being used in articulate speech, such as varieties of chirping, blowing, hissing, whistling, &c., which no tribe is known to have brought into their alphabet. Meanwhile we are very far from having exhausted the resources of the English alphabet. It appears that if the combinations of the twenty-six letters of the English alphabet were free, "so that any letter could be indifferently sounded with any other, the number of words which could be formed without any repetition would be $2^{26}-1$, or 67,108,863." † But as the formation of our vocal organs is such as to prevent us using the greater part of these conjunctions of letters, inasmuch as at least one vowel must be present

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* Tylor's *Primitive Culture*, vol. i. p. 155.

† Jevons's *Principles of Science*, vol. i. p. 197.

in each word and more than two consonants cannot usually be brought together, the actual number of available words is 100,000; an ample store for the present, seeing that Shakespeare uses no more than 15,000, a person of ordinary cultivation between 3,000 and 4,000, and an agricultural labourer only about 300.

In continuation of the foregoing exposition of the agency of motor residua in mental function, let me direct attention to their mental effects when they have been directly excited. In that condition which Mr. Braid called "hypnotism," it has been pointed out already that if the face or limbs of the patients are placed in an attitude which is the normal expression of a certain emotion, thereupon that emotion is actually excited; the motor intuition immediately awakening the appropriate conception. This is in accordance with what we frequently observe in watching the genesis of mind in young children, where it is plain that an attitude or gesture, unconsciously or involuntarily evoked, sometimes awakens in the mind the correlative idea or emotion, and where, on the other hand, every thought is immediately translated into some movement.*

It was taken notice of by Mr. Burke that when the body is disposed by any means whatsoever to such emotions as it would acquire by means of a certain passion, it will of itself excite something very like that passion in the mind. And he relates in confirmation a curious story told of the celebrated physiognomist Campanella:—"This man, it seems, had not only made very accurate observations on human faces, but was very expert in mimicking such as were any way remarkable. When he had a mind to penetrate into the inclinations of those he had to deal with, he composed his face, his gesture, and his whole body, as nearly as he could, into the exact similitude of the person he intended to examine; and then carefully observed what turn of mind he seemed to acquire by this change. So that, says my author, he was able to enter into the dispositions and thoughts of people as effectually as if he had been changed into the very men."* Let any one make the experiment of fixing the countenance in the expression of a certain passion, and, while retaining that expression, of trying to call up in the mind a quite different passion; he will find it impossible to succeed until he alters the expression of his face.

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* Vulpian (*op. cit.* p. 290) formularizes the general physiological law, that every excitation of a nerve, at any point in its length, is transmitted immediately and simultaneously both in a centripetal and centrifugal direction.

It may be remarked in this relation that these physiognomical expressions of the emotions are not really invented by the emotions which they express. The physiological mechanism which subserves them is innate in the individual, having been inherited by him as heir of the organized experiences of the race; wherefore the muscular expression of a passion is uniform in different persons, and may be excited into action before the feeling of which it afterwards seems to become a necessary part. The smile on an infant's cheek, which in after years corresponds with pleasurable emotions, is, as Sir C. Bell remarked, oftenest first seen when it is asleep, and is ascribed by the sage nurse to internal convulsions or irritation. Here the definite muscular action precedes the development of the mental state with which it is afterwards firmly associated. One observes the same thing sometimes on the face of a dying person, when the flitting smile, which might at the first glance seem to denote a happy thought, or the frown which would seem to mark a painful thought, is plainly the passing effect of some internal irritation. Here the special action of the features has survived the decay of the conscious state.

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* *Essay on the Sublime and Beautiful*, p. 261. "I have often observed," he says, "that on mimicking the looks and gestures of angry, or placid, or frightened, or daring men, I have involuntarily found my mind turned to that passion whose appearance I endeavoured to imitate; nay, I am convinced it is hard to avoid it, though one strove to separate the passion from its correspondent gestures."

I pointed out in a former chapter how essential a part the internal organs of the body play in the production of the passions, and how probable it is that the uniformity of passions among mankind is due to the uniform operation of these organs upon the brain; it is now seen that the motor expressions of the passions may be produced by stimuli from the internal organs before the development, and after the extinction, of the conscious mental states; the question, then, may fairly be raised whether the development of the conscious mental state is not in great measure owing to this sensori-motor activity of the organic life. When, for instance, the infant, immediately after its birth, performs the movements of sucking as a purely reflex operation, it is presumed to have no more conscious feeling of the act than the anencephalic infant which does the same thing; but is it not probable that the operation awakens in its mind by degrees the appropriate conscious state, the current of sensori-motor activity exciting centripetally its representative current in the convolutions, and that it acquires by this means the knowledge and the feeling of pleasure which are afterwards associated with the conscious gratification of the appetite for food? At an early period, when the feeble muscles of the arms and legs can hardly make a few indefinite movements, the muscles of the face, Cabanis has remarked, already express, by distinct movements, nearly all the series of general feelings peculiar to human nature, so that the attentive observer easily recognises in the picture the characteristic traits of the future man. It is, he says, not in external impressions that the causes of such complicated movements are to be found, for, with the exception of touch, the senses hardly exist; it is in internal impressions, in their simultaneous concurrence, in their sympathetic combinations, that we find the source of this language of the physiognomy.

The condition of disease known as aphasia, which has been so much studied during the last few years, is especially interesting in its bearing on the doctrine of motor intuitions. A person loses the power of expressing his thoughts by articulate language, understanding all the time perhaps what is said to him; and although in the majority of cases in which this happens there is hemiplegia of one side, generally of the right, there may be no paralysis at all. Moreover, in those cases in which there is hemiplegia, there is not any paralysis of the muscles of articulation; the loss of speech is not due to any defect in the actual instruments of utterance; nor is the loss of power of intelligent expression by speech owing in all cases, or entirely in any case, to the loss of intelligence, though it is certainly true that there is in many cases of hemiplegia some degree of mental failure—some degree of enfeebled intelligence and of emotional excitability. Intelligence, however, often fails or is lost without loss of the power of speech; and we certainly meet with occasional instances of the latter defect without any appreciable loss of intelligence—instances in which the patient is able to communicate his thoughts by gesture-language, or by writing. It is to be borne in mind, in regard to this question, that language consists essentially in the establishment of a definite relation between the idea and the sign by which it is outwardly manifested; that it may be verbal, vocal, graphic, or mimic; and that the general faculty of language includes all these modes of expressing the thoughts. The persistence of one or more of these other modes of expression, where the faculty of speech is lost, proves that, notwithstanding the intelligence is most probably weakened in most cases of aphasia, it is certainly not then weakened to such an extent that the loss of speech can be due to the abolition of ideas. It may happen in some cases that the power of speech is not entirely lost, the person making use of wrong words, either conscious or unconscious that he is doing so; in other cases, that he can make an apt emotional ejaculation under the influence of excitement when he is quite unable to speak his thoughts.

Where, then, does the immediate mischief in aphasia lie? The first movements of speech which a child makes are made in imitation of the sounds which it hears; they are of a reflex nature, and are executed by means of those parts of the pons and the medulla to which the auditory nerve goes—the nuclei of the facial, the vagus, and the hypoglossal nerves, which are in anatomical connection with the nucleus of the auditory. They are a development, so to speak, of the inarticulate cry which the new-born infant makes; itself a muscular action which implies the combined action of the expiratory muscles and of the muscles which narrow the rima glottidis. When in due time the definite co-ordinate movement of a word has been executed as a reflex act of the auditory nerve and the proper associated motor nuclei, it is echoed, as it were, in the higher representative centres in the convolutions, through the agency of the intercommunicating fibres which make the special connections between the lower and the higher centres—the *sensorial* and the *ideational* arcs. By repetition of this centripetal action the perceptive residua of the special sound are formed in the proper sensorial or afferent centre of the convolutions, and the associated motor residua of the special movements which effect its utterance are formed in the proper motor or efferent department of the convolutions; so that when the word is afterwards uttered voluntarily the stimulated sensory residua in the former excite the motor intuitions in the latter centres, which thereupon act centrifugally upon the motor nuclei. It is reflex action in higher centres—along the ideational arc.

This being the probable physiological mechanism of voluntary speech, we can easily perceive that disorder or loss of the function may be produced in more ways than one. If the continuity of a person's auditory nerve be interrupted, he will be deaf: deaf only, if residua of vocal sound have been stored up before he became deaf; deaf and dumb, if he was deaf before such residua had been acquired, that is, if he was born deaf. If the perceptive centres of the auditory nerve in the convolutions were clean cut out artificially, or entirely destroyed by disease or injury, all names would vanish from his memory; he would not be able to understand or to repeat voluntarily a word spoken to him. It is conceivable, however, that he might even under these circumstances occasionally repeat a word as a reflex or sensori-motor act if the auditory nucleus and its motor connections were uninjured. Moreover, he would not be without ideas, forasmuch as having still the residua of the perceptive centres of the other senses of taste, touch, sight, his ideas might be excited through these, and might even be uttered in speech by means of their action upon the proper motor residua. Hearing is necessary to learn to speak, as men do learn speech, but once speech has been learned, it may be excited by the action of other sensory residua which have been associated with its motor residua. His mind would be an utter blank when the name of an object was spoken to him, but he might recognise the object and utter its name when it was shown to him, or might know it through touch when it was put into his hands.

If the connecting fibres between the auditory centres in the convolutions and the associated motor residua in the frontal convolutions were destroyed, the person would understand everything said to him, and might certainly be able to speak freely, his motor residua being unimpaired, but he clearly could not make the connections between the sensory residua of sound and their proper motor residua. He could not select the right word through sound, although he might be perfectly conscious of his mistake if he used a wrong one, and would certainly be able to stimulate the right motor residua through the perceptive centres of the other senses. If the motor residua of speech in the frontal convolutions were entirely destroyed, the person, while understanding what was said to him, would not be able to speak a single word voluntarily; he could neither repeat voluntarily a word spoken to him, nor name an object placed before his eyes or made to affect any other sense, although it is possible that he might sometimes utter a word as a reflex sensori-motor act through the agency of the auditory nucleus and its motor connections. It may be supposed that the result of destroying the nerves connecting the motor arrangements in the frontal convolutions with the subordinate motor ganglia would, so far as speech was concerned, be the same as that which would follow the destruction of the motor arrangements in the convolutions. Looking to these different ways in which injury to the anatomical substrata of speech may affect its function, and bearing in mind that the injury will seldom be of so defined a character as that which has been assumed for illustration in the supposed cases, we shall not be surprised to witness the varying phenomena which are actually met with in different forms of aphasia. As will easily be understood, the difficulty is to observe accurately in a given case the exact nature and extent of the deficiencies which the person presents.

I am inclined to think that the intelligence is often more deeply affected in aphasia than is supposed by on-lookers, and than the patient himself is apt to believe. Reflecting upon the important, indeed the essential, part which the motor intuitions play in the mental life, it is hard to conceive how the loss of them can take place without secondary injury to the ideational functions—to the intelligence; this may not be primarily affected by the disease, but it cannot fail to suffer secondarily. Is it possible to think definitely and consecutively without that power of internal representation which we have in the motor intuition, and which, in thinking, stands for the outward utterance?* We may think, it is true, of concrete perceptions, but can we pursue a train of abstract thought? Even though the aphasic patient may not be himself aware of any mental failure, and may feel convinced that it is only the words to express his ideas that he lacks, yet it is not unlikely that his condition resembles somewhat that of a person in a dream, who fancies that he is thinking most logically, and discoursing most eloquently, when his thoughts are confused and his words incoherent. The history of cases of aphasia proves that this is certainly so sometimes. It is easy to comprehend the disputes which arise among on-lookers who endeavour to test the intelligence in these cases: when the regular channel by which intelligence expresses itself is closed, it must obviously be very difficult to appraise accurately the degree of intelligence. The simple questions which are usually put, for this purpose, to aphasic patients certainly do not decide the question: a demented person, whose mental faculties were almost abolished, might answer sensibly when he was asked so commonplace a question as what he would do if the room were on fire; and many patients in lunatic asylums whose intelligence is in a very shattered state are able to play cards and draughts skilfully. It is certainly quite possible for an aphasic patient to evince intelligent appreciation of simple questions and obvious suggestions when he has lost all power of sustained and definite thought. And, apart from all theoretical considerations, the evidence which exists at present is in favour of the opinion that the intelligence is often weakened in aphasia.

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* "Herein lies the necessity of utterance, the representation of thought," says Heyse. "Thought is not even present to the thinker, till he has set it forth out of himself. Man, as an individual endowed with sense and mind, first attains to thought, and, at the same time, to comprehension of himself, by setting forth out of himself the contents of his mind; and in this his free production, he comes to the knowledge of himself, his thinking 'I.' He comes first to himself in uttering himself."

There is one observation more to be made before passing from this subject. Some writers are in the habit of affirming that it is in names we think, and that they are the indispensable instruments of thought. "I therefore declare my conviction," says Max Müller, "whether right or wrong, as explicitly as possible, that thought in one sense of the word, *i.e.*, in reasoning, is impossible without language." Assuredly this sounds too absolute a statement. Is not the deaf and dumb man a living refutation of the proposition that man cannot reason without speech? The example of Laura Bridgman, who was deaf, dumb, and blind, as her case is admirably described by Dr. Howe, proves that a person may have human thought without being able to speak; and the instances of aphasic patients who can express their ideas in writing point in the same direction. But neither these instances, nor the case of Laura Bridgman, can be used to prove that it is possible to think *without any means of physical expression.* On the contrary, the evidence is all the other way. The deaf and dumb man invents his own signs, which he draws from the nature of objects, seizing the most striking outline, or the principal movement of an action, and using them afterwards as tokens to represent the objects.* The deaf and dumb gesticulate also as they think, and Laura Bridgman's fingers worked, making the initial movements for letters of the finger-alphabet, not only during her waking thoughts, but in her dreams.† If we substitute for "names" "the motor intuitions," or take care to comprise in language all the modes of expressing thoughts, whether verbal, vocal writing, or gesture-language, then it is unquestionable that thought is impossible without language. In man the tongue has been almost exclusively appropriated for the expression of thought, but there is no absolute reason why his fingers, hands, and arms might not be used, like the antennæ of ants, and the hands and fingers of the deaf mute, to express all the results of mental action.‡

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* "And whilst he silently elaborates the signs he has found for single objects, that is, whilst he describes these forms for himself in the air, or imitates them in thought with hands, fingers, and gestures, he develops for himself suitable signs to represent ideas, which serve him as a means of fixing ideas of different kinds in his mind, and recalling them to his memory. And thus he makes himself a language, the so-called gesture-language (Geberden-sprache); and with these few scanty and imperfect signs, a way for thought is already broken, and with his thought as it now opens out, the language cultivates and forms itself further and further." Many artificial signs are added by teachers to enrich the language. Kruse, Uber Taubstummen, 1853. He was a learned deaf mute, who is quoted by Mr. Tyler in his *Early History of Mankind*, p. 20.

† Tyler's *Early History of Mankind*, p. 70.

‡ And even to communicate such results by touch without the help of sight. In a Report of the Massachusetts Asylum for the Blind, Dr. Howe relates that a blind child, during the vacation, contracted St. Vitus's dance. When the school reassembled, another child soon manifested the disease, and soon afterwards a third. It was necessary to send these children home in order to prevent the whole school being infected through the imitative tendency. They soon recovered after separation. As the children were blind, it was not through sight that they were infected; but a knowledge and imitation of the disordered movements were acquired by close contact of the children with one another at their school-desks, in their sports, &c.

The reasons why the tongue has been specially selected for this purpose are obvious: first, because of its connexion with the vocal organs, whereby its movements, in conjunction with those of the lips, modify in a great variety of ways the different sounds, and thus make audible language, which is plainly on the whole more useful to man than visible language, for it would be extremely inconvenient if one person could not communicate with another without seeing or touching him; secondly, because of the great variety, delicacy, and complexity of movements of which the numerous muscles of the tongue are capable in so small a space, whereby the most delicate shades of thought and feeling can be expressed; and, thirdly, because the movements of the hands are required for other purposes, while it is difficult to perceive what other purpose the wonderful variety of the tongue's movements could have served, when it was not engaged in co-operating in the taking and mastication of food.*

The influence of the motor department of mental action, the region of actuation, might receive further illustration from the phenomena of insanity and of certain convulsive diseases. It scarcely admits of question that some of the delusions of the insane have their origin in what may justly be called motor hallucinations; a disorder of the nervous centres of the motor intuitions generates in consciousness a false conception or delusion as to the condition of the muscles, so that an individual lying in his bed believes himself to be flying through the air, or imagines his legs, arms, or head, to be separated from his body, just as he has hallucinations of sense when the sensorial centres are disordered. In dreams we may sometimes observe the same kind of thing, as when from hindered respiratory movements a person suddenly wakes up with the idea that he is falling over a precipice. Illusory movements, or illusory positions, are the characteristic traits of vertigo, which is the subjective aspect of the deranged motor factors; other subjective sensations, such as noises in the ears, flashes before the eyes, and painful sensations in the head, accompanying them. In dreams, and in drunkenness also, there is no power of correcting these subjective motor experiences; and the brain or mind, rendering them conscious, converts them into false conceptions of space.* Such motor illusions

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* It is a fact—nowise surprising when we consider what they inherit—that deaf mutes, who have been born so, do of their own accord, untaught, make vocal sounds more or less articulate, attaching a definite meaning to them, and using them afterwards in the same sense. In some these sounds are very clear and well defined.

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* "I had some years since," Dr. Whytt writes, "a patient affected with an erysipelas in his face, who, when awake, was free from any confusion in his ideas; but no sooner did he shut his eyes, although not asleep, than his imagination began to be greatly disturbed. He thought himself carried swiftly through the air to distant regions; and sometimes imagined his head, arms, and legs to be separated from his body, and to fly off different ways."—*Obs. on Nature, Causes, and Cure of Nervous, Hypochondriacal, and Hysteric Disorders.* 1765. A drunken man who may be fairly steady while his eyes are open, or while his motor centres are associated with sensory stimuli, gets subjective sensations of swimming in the head, sinking of his body, &c., when his eyes are shut.

The illusive effects which follow injuries of single muscles of the eye illustrate in a striking manner how the movements of the eye minister to our visual conceptions of space and of relations of position. If the external rectus of the eye is suddenly rendered powerless by an injury, the disposition to occasionally turn the eye outwards persists; but it is, of course, without result. The eye may be turned in all other directions, and the position of objects in the field of vision is correctly perceived. So soon, however, as it is attempted to turn it outwards, an apparent movement of the objects occurs towards the same side to which the futile effort to move the eye is made. This is owing to the fact that the person believes the eye, which is motionless, to move; the consciousness of the effort to move it is objectified, and produces the hallucination of an actual movement, and as the eye notwithstanding does not move, the objects appear to move. If the external rectus is only partially or hallucinations can of course only ensue when the reaction of the disordered motor intuition is into consciousness; if, as may happen, and commonly does happen, the reaction takes place outwards, there are irregular or convulsive movements, but no delusion is generated. In fact, when the *motorium commune* is disordered, its morbid function may be displayed in irregular or convulsive muscular action, and, if the deterioration proceed far enough, in paralysis; or it may react upon the mental life and give rise to disorder of intelligence. According as the disordered function acts in an upward or downward direction, centripetally or centrifugally, that is, according as it invades the sphere of consciousness or passes into outward expression, it occasions mental disorder or convulsions.

The phenomena of convulsions, properly examined, serve to illustrate the existence and to exhibit the independent action of the motor intuitions; their disconnected movements show plainly that there are special motor nerve-centres which may, when co-ordination is deranged, act independently. Be it noted that every kind of movement which may be normally excited by the will may occur as a convulsive act, when, of course, there is no question of the exercise of will, and when there is often an entire absence of conscious-

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paralyzed, the eye may be fixed upon an outward-lying object, but a stronger effort will be needed to do so. Accordingly the object will appear to be placed farther outwards than it actually is, and if the person makes a grasp at it, his hand will go beyond it. Thus the judgment of the position of an object in space is essentially determined by the feeling of effort which accompanies every impulse to movement. See WUNDT, *Grundzüge der physiologischen Psychologie*, p. 553, who has deeply discussed this subject; also BAIN, *The Senses and the Intellect*, where it is treated in thorough detail. It appears that Mr. Bain's theory and exposition of the nature of our perception of space agrees in essential points with that of Steinbuch. (*Beitrag zur Physiologie der Sinne. Nürnberg*, 1811.)

ness. As the individual in sound health must give intense attention in order to isolate a certain muscular movement which usually takes place as a part of a complex series, and cannot always then succeed, it is nowise surprising that there should often be more or less co-ordination of movements in spasmodic or convulsive muscular action. Indeed, it would be surprising if there were not. In cases of cerebral hæmorrhage, it sometimes happens that the articulating movements of single sounds, or of a certain series of sounds, syllables, or words, are produced without any mental act or even against the will of the patient; in like manner, other co-ordinate movements take place sometimes without the least trace of consciousness being evinced. We shall not be surprised at the occasional occurrence of speech movements and of other definite acts during complete unconsciousness if we call to mind how poetry which has been thoroughly learned may be repeated mechanically, while the attention is engaged on something quite different; the repetition, once started, being indeed most successful when done with least consciousness. As examples of general spasmodic action of the body, co-ordinated nevertheless into a particular outcome, Romberg relates a remarkable case of what he calls rotatory spasm in a girl ten years of age, and another case of co-ordinated spasm in combination with chorea, which occurred in a boy aged six, who was occasionally attacked with an irresistible desire to climb in spite of every impediment; in the intervals he was affected with chorea. Consciousness is not always entirely abolished; and in that case the patients are able to give an account of the impulse which instigates the movements, and which they are unable to withstand successfully.

It is a well known fact that the idea of convulsions, whether excited by present perception or through memory, may express itself in convulsive movements

—movements which, nevertheless, often display a considerable amount of co-ordination. Everybody perceives how, in a healthy person, swallowing, coughing, and yawning are excited by the observation of these acts in another; and as instances of similarly produced morbid actions, Romberg adduces those dancing epidemics of the Middle Ages, in which co-ordinate spasmodic movements were notoriously excited in delicate women, and continued by them with a violence and persistence which would soon have exhausted the strongest man who was in a normal mental state. Persons who are labouring under acute mania frequently keep up an unintermitting succession of purposeless, irregular, and mischievous or destructive acts, which nevertheless evince a considerable amount of co-ordination—a complex co-ordination of acts, I mean, not of individual movements simply; their actions, like their ideas, are delirious and incoherent. They are complex machines which, being out of order, go on in deranged action. Will represents the highest co-ordination of the ideas, feelings, and movements; when disease has destroyed this highest acquisition of evolution, we have, so to speak, a resolution of will into the component factors, which now act on their own account—automatically: the uncontrolled act of passion, or the convulsion of a limb, is a loss of power of will, because it is an independent act, no longer in due co-ordination with, or subordination to, other functions of the mental organization. It behoves us to keep well in mind, and to appreciate the full bearing and import of, the fact that as so many of our co-ordinate actions are done automatically in health, so there may be much co-ordinate automatic action in the convulsive phenomena of disease.

There yet remain further important considerations. Let a man have the will to command a certain movement and a conception of the result desired, without any paralysis of motor power, he may still be impotent to perform the movement. And why? Because there may be a paralysis of sensibility in the muscles of the part, by reason of which he has no means of knowing what is the condition of the instruments which he has to use—cannot tell whether they are acting or not ; he lacks that information which the muscular sense should rightly yield him.(¹) In order that the will may actuate a movement, there are necessary, then, not only a conception of the end desired and a motor intuition of the muscular movements subserving that end, but also a sense of the action of the muscles. Any psychological arguments as to the value of this guiding muscular feeling are rendered needless by pathological experience, which plainly proves that, when the muscular sense is paralysed, the movements cannot be performed, except some other sense come to the rescue ; or, at any rate, that when all the other senses are seemingly perfect the movement cannot be performed, presumably because of the loss of the muscular sense. It is not to be looked upon as an actively conscious sense, like sight or touch, but rather as of the nature of organic sense, giving its information and working its effects without definite consciousness. The sense of sight may take its place when it is lost : a woman whom Sir Charles Bell saw, who had lost the muscular sense in her arm, could nevertheless hold her child when she kept her eyes upon it ; but the moment she turned her eyes away she dropped the child. I have seen a similar instance of a woman, epileptic in consequence of syphilis, who had lost the muscular sense in her left arm, and who did not know, except she fixed her eyes upon the limb, whether she had got hold of anything with her hand or not ; if she grasped a jug, she could hold it quite well as long as she looked at it, but if she turned her eyes away she dropped it : she had no loss of tactile sensation.

In such morbid states the difference between tactile sensation and the muscular sense is well marked.* "Ollivier details a case in which the patient had lost the cutaneous sense of touch throughout the side in consequence of concussion; at the same time he was able to form a correct estimate of the weight of bodies with his right hand. The physician observed by Marcet, who was affected with anæsthesia cutanea of the right side, was perfectly able to feel his patient's pulse with the fingers of the right hand and to determine its frequency and force, but in order to determine the temperature of the skin he was obliged to call in the aid of his left hand." Anæsthesia of the muscle, without loss of tactile power, does, according to Romberg, invariably accompany the disease called tabes dorsalis."* The eyes of patients so affected are their regulators or feelers, and consequently their helplessness, when their eyes are shut, or they are in the dark, is extreme; if told to shut their eyes while in the erect posture, they begin to oscillate until they fall down, unless supported. The skin remains sensitive except during the last stage of the disease.

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* Those who deny the existence of a special muscular sense hold that the information which we have of the position and movements of our limbs is furnished by the tactile sense, and by the sensory nerves distributed to the ligaments, the joints, &c. Certainly we are conscious of the position of a limb in passive movements, when, as it is moved for us, we appear to make no muscular exertion. But it is not then as passive as a dead man's limb. There is some muscular tension. Moreover it is true that, when there is cutaneous insensibility without loss of muscular feeling, the perception of our own movements is considerably disturbed. It would appear that the perception of the position of a limb is really a complex product produced by the fusion of manifold local sensations of touch with our various muscular feelings, and that, once formed, it is excited by stimulation of any one of the simple sensations from the fusion of which it has proceeded—by any one of its constituent sensations; just, in fact, as a perception is excited by the stimulation of any one of the special senses from the sensations of which it has been constituted—*e.g.* the perception of an orange through touch, or smell, or taste, or sight. When we are lying in bed at perfect rest, without the least movement of a muscle being made, and without the least movement of anything that is in contact with the surface of a limb, we may be uncertain or unaware what its exact position is; but the moment a slight muscular contraction is made, or the moment a sensation of touch is produced by the least movement of the limb, or by the slightest movement of the clothes covering it, we have an instant perception of its position.

Romberg, Duchenne, and others have, moreover, described similar morbid conditions in anæmic and hysterical women, which can hardly be called paralysis, as they are manifest only in the night or when the eyes are shut: the patients can perform movements, but these do not answer accurately to the will; they are deceived as to the amount of force necessary to be put forth, and sometimes cannot undertake the movement of a limb without the help of sight. In these cases there is the desire to effect a certain action, there is the motor intuition of the movement necessary to the end desired, but the guiding sensation of the muscular sense is defective or wanting accordingly the action cannot be done unless the sense of sight takes upon it the function of the defective muscular sense.

These and similar cases ot disease seem to me to throw some light upon the nature of that which we mean when we speak of directing the attention and exerting the will strongly. In order to direct the attention and exert the will sufficiently in these cases in which there is some temporary exhaustion or morbid enfeeblement of the motor faculties, and a powerful stimulus is necessary to do what a moderate stimulus will usually do, the sensory stimulus of the muscular sense must be strengthened by the co-operation of the stimulus from the sense of sight, to which will be added the stimuli from the acting muscles of the eye. In this way the excito-motor process is aroused by a more active stimulus; for the sum of the contributions of co-operating stimuli from different senses amounts to the same thing in this relation as the more powerful action of a single stimulus. The direction and the exertion of will are really a solicitation or excitation of greater excito-motor energy, and consequently of more active consciousness (*i.e.* attention) through the agency of co-operating sensory stimuli: the process is purely physiological. It is in the same way that the exhausted debauchee, who is impotent in response to the natural sensory stimuli, succeeds in arousing the excito-motor function of sexual gratification by bringing to bear upon each sense all the depraved stimuli to which it is sensible, thus accumulating a sufficient stimulus to produce the desired excitation. If he be a person of strong imagination he may perhaps succeed in producing the effect by a vivid mental representation, without actual presentation, of the impressions which are adapted to act as stimuli on the different senses. Thus it appears that, as was before set forth, what we call directing consciousness by a voluntary effort is really the excitation of consciousness in consequence of the greater activity of cerebral processes which is produced through the co-operation of as many stimuli, internal or external, as it is possible to bring into action.

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* It must be remembered that simple loss of muscular feeling is not tabes dorsalis. In tabes dorsalis, the characteristic phenomenon is a loss of the power of co-ordination of the muscles, and the morbid appearances are those of degeneration of the posterior columns of the spinal cord—the motor repository or centres of co-ordination of the movements of the limbs. Hence the disease is now more properly called progressive locomotor ataxy. Loss of muscular feeling is a symptom that may occur in different diseases; if another sense takes its place, movements are still effected; so that the power of movement, the repository of motor residua, is not affected.

What relation has the muscular sense to the motor intuition? It is not an easy question to answer either from a psychological or from a physiological basis, inasmuch as it is not easy to put asunder in thought what nature has joined together. The relation appears to be not unlike that which the sensation of a special sense has to the corresponding idea: as the sensation of the special sense is necessary to the formation of the idea, but, the idea once formed, not necessary to its existence or function, so the muscular feeling would seem to be an essential prerequisite to the formation of the motor intuition, but, this once formed, not necessary to its latent existence, or indeed to its active function, provided only another sense furnish the guiding information. Like other senses, the muscular sense is receptive; it ministers to the building up of the fundamental ideas of solidity, size, figure, and distance, through the impressions which it receives from without and conveys inwards, and the subsequent internal adaptations which take place; and in the outward intelligent reaction of the individual upon external nature, by virtue of these ideas, it furnishes the guiding feeling by which he is enabled to direct the action and to regulate the amount of force applied in any given case. In point of fact, the consolidation of its different impressions with the adapted movements constitutes the perception of the object—constitutes what is, so far as we are concerned, the *object:* how then can we act practically in relation to the perception, when the sensory contributions are taken out of it, and when it is no longer therefore to us the definite object, unless some other sense supplies what is wanting and so completes the perception—in other words, reconstitutes the object for us? How admirably graduated is the application of force by the skilful hand in delicate handicraft operations! How clumsy and incapable is the beginner in such crafts until, by frequent practice, the requisite motor intuitions have been acquired! Consider how awkward any one is at so simple a matter as winding up a watch for the first time, and how quick, easy, and precise the operation afterwards becomes. Observations made upon persons born blind prove that there is nothing essential to the highest intellectual processes which may not be acquired in the absence of sight, mainly through the muscular feeling in combination with touch. (2)

Because the muscular feelings in combination with tactile and other sensations gradually build up the motor intuitions in accordance with the order, synchronous or successive, of our experience, it is not difficult to deceive them by a new experience modifying or reversing that order. They are inductions, and, like all inductions *per enumerationem simplicem*, they are liable to be upset by the *instantia contradictoria*. We have already shown how the eye may be deceived, and there is a familiar example of similarly produced illusion in the case of touch. It is well known that, if the middle finger be crossed over the fore-finger, and a pea or a like round body be put between them and the fingers rolled over it, while the eyes are turned away, there will be the sensations of two bodies; the impression on that side of the fore-finger which is habitually associated in action with the thumb excites independently its residua, and the impression on that side of the middle finger which is accustomed to act with the third finger excites also its residua; the consequence is a feeling of two bodies which it requires the evidence of another sense to correct. So closely and definitely are our different senses associated in their functions that they may, instead of aiding and correcting one another, as is their proper function, thus actually help to deceive one another when the order of their experiences is unexpectedly deranged. When the metal potassium was first shown to an eminent philosopher, he exclaimed, on taking it into his hand, "Bless me, how heavy it is!" and yet potassium is so light as to float on water. The metallic appearance had suggested a certain resistance, or the putting forth of so much muscular energy as previous experience of substances having a similar look had proved necessary; the consciousness of the effort made instigated the false judgment, the suggestion of the visual sense overswaying the actual experience of the muscular and tactile senses: the latter were deceived, as the man is who concludes that a certain co-existence or succession in nature must always exist because he has observed it in a great many instances; or as, at the supposed disinterment of a body suspected to have been murdered, one of the spectators who fainted on account of the bad smell was deceived; for, when the coffin was opened, it was found to be empty.

It is well-known that a person feels sensations in a limb, and is conscious of its different positions, as if it were present, for some time after it has been amputated. "Urging a patient who had lost his leg to move it," says Sir Charles Bell, "I have seen him catch at the limb to guard it, as if forgetting that it had been removed. Long after his loss he experienced a sensation not only as if the limb remained, but as if it were placed or hanging in a particular position or posture. I have asked a patient, 'Where do you feel your arm now?' and he has said, 'I feel it as if it lay across my breast,' or that it is 'lying by my side.' It seems also to change with the change of posture of the body. These are additional proofs of a muscular sense; that there is an internal sensibility corresponding to the changing condition of the muscles; and that as the sensations of an organ of sense remain, after the destruction of the outward organ, so a deceptious sensibility to the condition of the muscles, as well as to the condition of the skin, will be felt after the removal of a limb." *

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* *The Hand, its Mechanism and Vital Endowment.* Dr. Weir Mitchell has found that electrical stimulation of the nerves of a stump

The perfect functions of the motor residua are not only essential to the expression of our active life, but, like the functions of the special senses, they are essential constituent elements of our mental life. In the common form of the disease which is known as general paralysis of the insane there are two prominent characteristics: the first is the general paralysis, in greater or less degree, of the muscles of the body; and the second is the extraordinary delusions of grandeur. It is a question well worth consideration, whether these characteristic symptoms do not stand in some degree of causal connection with one another. A tailor who is suffering from general paralysis will readily promise to make a magnificent coat or waistcoat, and, if the materials are supplied to him, will at once set to work. It is not improbable that, deceived by his quiet assurance, and knowing that to sew is his business, one may believe that he can make the garment. But, in a little while, it will be found that his stitches are most unequal in size, and are placed in the most disorderly way; and it is made clear that, whatever he himself may think, he certainly cannot sew properly. He has a sufficient desire to accomplish the result, an adequate general notion of the end desired, a full belief in his ability to effect it; but he fails because his motor residua are disordered, and because he cannot regulate precisely the action of the necessary muscles. And because his disordered motor intuitions have invaded consciousness, he does not realise his failure, but is happy under the delusion that he has accomplished his work admirably. We must not overlook the effects upon consciousness as well as the effects upon movements: as the sleeper, whose external senses are so closed as to shut out the controlling influence of external objects, often does in his dreams the most wonderful things, and finds little

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will give rise to vivid feelings of different positions of the lost limb long after it has been removed.

or no hindrance to an almost miraculous activity, intellectual and bodily; so the general paralytic, whose disordered motor residua cut him off from the due appreciation of external relations, and suggest false intuitions of these relations, has the most extravagant notions as to his personal power and prowess engendered in his mind; he dreams with his eyes open.* As we owe mainly to the muscular sense the development of our fundamental ideas of resistance, form, size, and space, it will easily be understood that, when this sense is deficient throughout the body, as in the general paralytic, there cannot be that intelligent accord between the inner life and the outward relations which, when in a perfect state, it maintains. Here, again, we perceive how impossible it is to separate the mental from the bodily life; how plainly, when we scan the deeper relations of things in their genesis, there are displayed the closest connection and continuity of parts and functions.

To the action of the will, as already pointed out, a conception of the result is essential, whether the volitional exertion be for the purpose of causing a movement, of preventing or checking a movement, or of dismissing a painful idea from the mind. When a sensation excites a co-ordinate movement in so-called sensori-motor action, we do not say there is a conception of the result, because of the absence of consciousness; but at the same time we must admit that there is a definitely organized residuum in the proper motor nervous centre, which, as it were, implicitly contains the movement. Now it is important to bear in mind, when the movement is cerebro-motor, the will exciting that co-ordinate movement which a sensation alone may do, as not unfrequently happens, that it cannot operate directly on the motor nerves, but must necessarily operate through the medium of the same motor agency as that through which the sensation acts: in other words, the movement in both cases proceeds directly from the motor nervous centre in which the movement is latent. In both cases it is truly reflex, the stimulus in one case coming round by the convolutions, in the other case more directly across from the senses. If we could excite the motor centres artificially, not over-exciting and injuring them, as in our gross experiments we necessarily do, then we should not fail to set free the definite movements. Speaking psychologically, the conception of the result becomes in the execution of voluntary movements the motor intuition, and the motor intuition excited into activity expresses itself in the designed movement through the agency of the subordinate motor centres.

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* I once had under my care a general paralytic who was occasionally much excited, believing that he was fighting great battles, and winning great victories with his fists; he believed, too, that he won immense sums of money as wagers on his prowess. The disorder of his *motorium commune* entered into his thoughts and engendered corresponding delusions. He was confined to his bed or couch by reason of having lost one leg, or he would have been a violent and dangerous patient.

Thus, then, it appears that, as in the action of nature upon man, the stimulus which is not reflected in the spinal cord passes upwards and excites sensation, and the stimulus which is not reflected in sensori-motor action passes upwards and becomes idea, and the stimulus which is not reflected in simple ideomotor action passes from cell to cell in the hemispheres and excites complex ideation or reflection; so in the reaction of man upon nature, the energy which we designate psychologically the will, passes downwards through the subordinate centres in an opposite direction: the will involves a conception of the result or a definite ideational action; the conception of the result demands for its further transformation the appropriate motor intuition; and the motor intuition gets its due expression in movement through the perfect function of the muscular feeling and the integrity of the motor nerves and the muscles. There is an orderly subordination of the different nervous centres; a chain of means such as is revealed in every department of nature. Taking a survey of the different sciences, we perceive that chemistry is dependent on physics, while physics is independent of chemistry; physiology is dependent on chemistry, while chemistry is independent of physiology; sociology is dependent on physiology, while physiology is independent of sociology: and so the just analysis of our mental life proves that sensori-motor action is dependent on reflex action, while reflex action is independent of sensori-motor action; ideomotor action is dependent on sensori-motor action, while sensori-motor action is independent of ideomotor action; the will is dependent on ideomotor action, while ideomotor action is independent of the will. These different epochs, as we might call them, in the order of development of the nervous system are represented by different classes of the lower animals: and it is interesting to note that, as in man there is a subordination of parts, and the will, as the highest energy, controls the inferior modes of nervous energy, so in the animal kingdom there is a subordination of minds, and the mind of man, as the highest development, controls and uses the inferior minds of many of the lower animals. There can be little doubt that his supremacy has checked the evolution of other animals which would probably have gone on had he not appeared on the earth.

If execution has been in any wise answerable to conception, I have now said enough to prove the importance of that region of mental activity in which dwell the motor residua, and which may properly be named the region of actuation. I have only to add that men differ much naturally as to the perfection of this as of other mental faculties. There are some who, with great intellectual power, never can attain to the ability of successfully expressing themselves; there are others, on the other hand, who can pour forth endless talk with the most facile fluency. The *art of expression* in speech, or in writing, or even in eloquence of action, is one which, if there is not an innate faculty for it, can never be acquired in its highest perfection: unseen fetters hinder the full utterance, and lame execution falls far short of ambitious conception: with the distinct conception of what they would say, and the best will to say it, there is something wanting in the region of actuation, whereby they are prevented from doing justice to their thoughts, and are compelled, like Moses, to delegate that function to others. "There is Aaron: he shall be thy speaker, and thou shalt be to him instead of God." (Exodus iv. 16.) *

It might be said perhaps that when a person is unable to express his thoughts clearly in suitable language it is that he has not the thoughts clearly conceived in his mind, that they are vague and only half formed, floating in an undefinable, hazy, or nebulous state. Without doubt, when a thought can be properly expressed it has acquired a precision and a definiteness of relation to other thoughts which it had not before it was embodied in language; but it may be fairly doubted whether it is correct to describe as only half formed all those thoughts which cannot have full justice done to them in speech or in writing. There are few persons accustomed to think who have not experienced occasions when the mind has seemed to be illuminated by a vivid flash of intuition, or the emotions to have reached a strain of exaltation which transcended the capacities of expression in adequate words; true or not, they have believed themselves to have had thoughts too deep for words and feelings that were unutterable. To me it seems that this occurs sometimes in coherent dreaming, and that one awakes with a feeling of despair at the inability to grasp definitely and to fix in words what has passed through the mind; with a conviction, moreover, that what has been lost was not a mere illusion, but of genuine worth. How much, again, of the depth and subtilty of thought is sometimes lost in the feeble and inadequate expression! How great a part of the mental effect produced by the highest poetry or the best art is that which is not expressed, but suggested, and which cannot be expressed, being unutterable! It would not be prudent to predict what the course of human evolution will be through the ages to come, but, whatever it be, it can hardly fail to be accompanied by a more complex, special, and subtile development of the powers of expression.

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* And a greater than Moses or Aaron was so gifted with the faculty of excellent expression, that it was said of Him that "Never man spake like this man."

Certain it is that there has been a continuous development of language through the past ages of human life. Language was not a gift miraculously bestowed upon man, nor a conscious invention which was designedly improved by him, but it is essentially an organic growth which has proceeded from the instinctive or unconscious life, and has been brought to its present completeness by the accumulated contributions of successive generations of men. It would be obviously absurd to conclude concerning the beginnings of human language from the multitude of words possessed by any language of the earth at the present day. If the history of a language be traced back for a few hundred years, it will at once be seen how much it has changed in that time; how many new words have been added to it; and how much some old words have gradually changed their meanings, while others have fallen into disuse and become obsolete. Could we trace back language to its earliest beginnings, and strip from it each fresh acquisition at the time and place where it was made, we should gradually lay bare its early nakedness and poverty, discovering it to consist of a few primitive roots answering to the feeble intellectual shoots of the race. But we cannot go so far back. When we follow the course of development of the Indo-European languages backwards as far as we can, there is no certainty that the roots which we reach are original; on the contrary, it is almost certain that they are not; that they are transformations; that what we know to have been going steadily on in historic times has gone on in the pre-historic times of which we can only darkly guess.

Language in all its forms consists of signs, and a sign is a particular movement which is in definite connection with a certain sensation or thought; sensory impressions or subjective states being reflected in objective movements. The definite movement is accordingly the sign of the internal state, and its relations are essentially social not individual. To the action of the environment upon the individual there is reaction by him in a modification of the environment—he feels and understands what *is* in order to determine what *is to be*: were he a solitary being, he would require to make only those adapted movements that were necessary to self-preservation, such movements being, as it were, a silent language addressed to, and understood of, nature; but as he is not a solitary but a social being, as he must react upon human nature, he makes, in answer to social impressions, for the purpose of mutual communication, movements that are of social meaning, and these movements develop into the different forms of language. Language, therefore, is truly a social growth, giving unity and cohesion to the social organism.*

There is every reason to suppose that the earliest form of language was the involuntary language of action and of cries, giving expression to feelings, and that the voluntary language of speech, giving expression to thoughts, was a later development. In the higher animals definite acts are the constant signs of the feelings which actuate them; they are the language of action, understood by all creatures similarly organized, and understood by man in virtue of the groundwork of organization which he has in common with them. Gestures and cries are largely used in like manner by the lower races of mankind, among whom the social life is very imperfect, to communicate their feelings. The Bosjesmen are said to make so much more use of gestures than of speech that they are unintelligible to one another in the dark, and are compelled, when they want to converse at night, to assemble round their camp-fires. To this basis of emotional gesture-language must be traced the source or root of the voluntary language of speech which has reached so complex a development in man. For as social relations were multiplied and expanded, and became more special and complex, answering multiplications and complexities of movements were necessitated; the interchange of feelings passed into an interchange of thoughts; and the requisite means of intellectual expression were found in the numerous, complex and delicate movements of speech, the convenience of which has led to its almost exclusive adoption. Because of this development of the complex voluntary language of speech in man, the involuntary basis of language is best studied in the lower animals, where it is presented in its simplest form; for they, checked in evolution by the ascendency of man, have never passed from the language of feeling—gestures and cries, to the language of thought—speech. Cries and gestures are also the language of infants; and under the influence of strong excitement the vocal organs of the adult act involuntarily, the cries of joy, horror, fear, amazement which give utterance to the internal feelings being intelligible, without instruction, to all beings similarly organized. When feeling is expressed in speech, it is by modification of the vocal *tone;* and tone is original, involuntary, not acquired and designedly used. In monosyllabic languages the same word has different meanings at the present day according to the tone in which it is uttered. Thus, in the child and in the least developed languages we find what may be justly considered as survivals of an operation which has had large sway in the original formation of language.

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* Comte, *System of Positive Polity*, vol. ii., *Social Statics*.

By whatever differences of tone of voice, or by whatever differences of movements, an animal may express its different feelings, it is doubtful whether any animal has ever got so far as to appropriate a special call to a special person or object—to name it; unless it be in a few rare instances in which it has been taught to do so by man. Certain it is that if animals have such a power it is of the most rudimentary kind, and has not undergone any development. So soon, however, as a child has consciously called its father or its mother, which it soon learns to do by using the special call for each, language in its true sense has commenced.* In the same way, no doubt, language began with the race of man: special names were given to special objects, and special words appropriated to express special feelings whereby mutual communication was accomplished. When, as we are informed, the Lord God, having formed out of the ground every beast of the field and every fowl of the air, brought them unto Adam to see what he would call them, "Adam gave names to all cattle, and to the fowl of the air, and to every beast of the field, and whatsoever Adam called every living creature, that was the name thereof." The story indicates the mode of origin of language as a product of man's development; and if Adam be interpreted to mean the successive generations of men that have in turn contributed to the formation of language, as scientific theologians or theological scientists interpret the formation of every living thing out of the ground to mean the process of evolution going on through successive ages, pious hearts need not be troubled, but may take courage and exult that each new scientific discovery is a new confirmation of faith, when Biblical history is interpreted in the largely liberal spirit of those who think "there be not impossibilities enough in religion for an active faith."

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* It appears that the earliest sounds made by the child—*Ma* and *Pa*, are met with in all languages. They are natural sounds, the special meaning being given to each by the parents. For in some languages *Pa* is mother, and *Ma* father. *Völkerkunde*, von Oscar Peschel.

It does not seem hard to conceive how, once the first step was reached, once the communication of a thought, feeling, or want was designedly made by one being, by means of a definite vocal expression, and was understood by another, the development of language gradually took place coincident with, or sequent to, the development of intelligence. But how was the first step made—the first mutual understanding come to between the maker of the sound and the hearer of it? We may conceive perhaps how this was if we call to mind what may be observed any day in the barn-yard when the cock, having discovered a grain, calls the hens by a special note, who understand and flock round him. It may be observed too that he will astutely pretend to have made a discovery, and will use a similar call, when he wishes to bring the hen to him in order to gratify his sexual want. That the hen is sensible of the difference of call and apprehends guile is plain, for it often shows itself coy, making a timid approach as if suspecting mischief, and will not come close to him, but must be pursued.

Here, then, in the food-wants and the sexual wants we perceive how there must have arisen vocal communication and understanding thereof among primeval human beings. In like manner, other feelings would have their expression which would be understood: an angry bite or blow or scratch could not fail to give meaning to, and to teach the meaning of, the accompanying tone or gesture.

It is probable, as I have already explained, that the earliest vocal language consisted of these vocal expressions of wants and feelings, and that the naming of objects, or the development of language as an instrument of the intellect, was subsequent. How this naming of objects was done is a question the answer to which must be left to those who are learned in the knowledge of the origin and development of languages, when they have come to an agreement among themselves. To one who has no pretence to special knowledge of the subject it would seem that it was done then, in the main, as it is done now by children, by the imitation of the sounds by which attention was attracted to the object; that the word was formed by imitation of the sound, and the connection of the idea with it made subsequently, sensori-motor having preceded ideo-motor function. Thus for example, the child hears the dog bark, and thereupon imitates the sound, making a *bow-wow;* the idea of a dog is expressed afterwards by making this sound. It is when a child is born deaf, and hears therefore no sounds to imitate, that it is dumb; it is not dumb when it is born blind, though it is then deprived of the chief avenue of ideas, because it does hear sounds which it imitates. There is in man an innate aptitude to imitation, which may be regarded as an expression of the reflex function of the nervous system; it is very evident in children, and more so in the mimicry of his next-of-kin, the monkeys. It is obvious that this process of verbal naming by imitation could take place only in relation to sounds, and that the perceptions of the other senses must have been named in another way. Still, if a person had got so far as to name the perceptions of one sense, it would not be a great step forward to designate the perceptions of the other senses by arbitrary signs; for the deaf and dumb have invented their own signs, drawing them from the nature of the objects or from the outlines or principal movements of actions, and many of their signs are said to be the same as those used by the Indians from Hudson's Bay to the Mexican Gulf. Men all over the world do in fact hit upon the same gesture-language to express themselves, and we may justly conclude that if they had not had speech they would still have acquired a means of communicating with one another by signs; they could not well have helped it, so long as they were beings endowed with a capacity of reacting to multitudinous impressions by answering varieties of movements.

So much then concerning the origin and development of language; it is the highest display of reflex function, and the most complex and special evolution of man's relations to his social environment. Using the words of Comte, we may say that "it is the expression of that essential unity which religion creates," being essentially relative to the social and not to the individual side of man, and presupposing the co-operation of men in association through successive generations. "The very sophism by which they [retrograde philosophers] blaspheme humanity itself could not be uttered at all, but for a system of expressions which are the work of long generations of men."* These embody the slowly won experiences of past ages; and in teaching them to those who will come after us and carry forward the torch when it falls from our failing grasp, we are exerting upon them through words all the influences which the objects in nature denoted by them have, during countless ages, exerted upon those who have gone before us; for it is in language that the wisdom of past generations is enshrined, and through it that each succeeding generation inherits the accumulated knowledge of preceding generations.

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* *System of Positive Polity*, vol. ii. Translated by Frederic Harrison.

NOTES.

[1] (*p.* 487).—"When a blind man, or a man blindfolded, stands upright, neither leaning upon nor touching aught; by what means does he maintain the erect position? The symmetry of his body is not the cause. A statue of the finest proportion must be soldered to its pedestal, else the wind will cast it down. How is it, then, that a man sustains the perpendicular posture, or inclines in due degree towards the wind that blows upon him? It is obvious that he has a sense by which he knows the inclination of his body; and that he has a ready aptitude to adjust the parts of it, so as to correct any deviation from the perpendicular. What sense is this? He touches nothing, and sees nothing; there is no organ of sense hitherto observed which can aid him. Is it not the sense which we have seen exhibited so early in the infant, in the fear of falling, and which caused its struggles while it yet lay in the nurse's arms? It can only be by the adjustment of muscles that the limbs are stiffened, the body firmly balanced, and kept erect; and there is no other source of knowledge but a sense of the degree of exertion in the muscular frame by which a man can become conscious of the position of the body and action of the limbs, while he has no point of vision, or the contact of any external body, to direct his efforts. In truth, we stand by so fine an exercise of this power, and the muscles, from habit, are directed with so much precision, and with an effort so slight, that we do not know how we stand. But if we attempt to walk on a narrow ledge, or rest in a situation where we are in danger of falling, or balance on one foot, we become subject to apprehension: and the actions are then, as it were, magnified and demonstrative of the degree in which they are excited. Although we touch nothing, and see nothing, yet we are sensible of the position of our limbs; that the arms hang by the side, or that they are raised and held out. And it must be by a property internal to the

frame that we know this. At one time I entertained a doubt whether this knowledge proceeded from a sense of the condition of the muscles, or from a consciousness of the degree of effort which had been directed to them in volition. But I reasoned in this manner—we awake with the knowledge of the position of our limbs; this cannot be from recollection of the action which placed them where they are; it must, therefore, be a consciousness of their present condition. When a person just after awaking moves his body, it is with a determined object; and before he can desire a change or direct a movement, he must be conscious of a previous condition."—Sir C. BELL, *The Hand, its Mechanism and Vital Endowments.* The question is whether we do awake with the knowledge of the position of our limbs—whether we are not without that knowledge until some movement, it may be ever so slight, is made.

[2] (*p.* 492).—In the forty-third Annual Report of the Massachusetts Asylum for the Blind, Dr. Howe gives an interesting description of the method which he employed for the instruction of Laura Bridgman, who was totally blind and deaf, and who had only a very indistinct sense of smell. I quote Dr. Howe's description entire:—

"I found in a little village in the mountains a pretty and lively girl, about six years old, who was totally blind and deaf, and who had only a very indistinct sense of smell; so indistinct that, unlike other deaf-mutes, who are continually smelling at things, she did not smell even at her food. This sense afterwards developed itself a little, but was never much used or relied upon by her. She lost her senses by scarlet fever so early that she has no recollection of any exercise of them. Her father was a substantial farmer; and his wife a very intelligent woman. My proposal to try to give regular instruction to the child seemed to be a very wild one. But the mother, a woman of considerable natural ability, animated by warm love for her daughter, eagerly assented to my proposal, and in a few days little Laura was brought to my house in Boston, and placed under regular instruction by lessons improvised for the occasion.

"I shall not here anticipate what I intend to write about her, further than to say that I required her by signs, which she soon came to understand, to devote several hours a day to learning to use her hands, and to acquiring command of her muscles and limbs. But my principal aim and hope was to enable her to recognize the twenty-six signs which represent the letters of the alphabet. She submitted to the process patiently, though without understanding its purpose.

"I will here give a rough sketch of the means which I contrived for her mental development. I first selected short monosyllables, so that the sign which she was to learn might be as simple as possible. I placed before her, on the table, a pen and a pin, and then, making her take notice of the fingers of one of my hands, I placed them in the three positions used as signs of the manual alphabet of deaf-mutes for the letters *p e n*, and made her feel them, over and over again, many times, so that they might be associated together in her mind. I did the same with the pin, and repeated it scores of times. She at last perceived that the signs were complex, and that the middle sign of the one, that is the *e*, differed from the middle sign of the other, that is *i*. This was the first step gained. This process was repeated over and over, hundreds of times, until, finally, the association was established in her mind between the sign composed of three signs, and expressed by three positions of my fingers, and the article itself, so that when I held up the pen to her she would herself make the complex sign; and when I made the complex sign on my fingers she would triumphantly pick up the pen, and hold it up before me, as much as to say, 'This is what you want.'

"Then the same process was gone over with the pin, until the association in her mind was intimate and complete between the two articles and the complex positions of the fingers. She had thus learned two arbitrary signs, or the names of the two different things. She seemed conscious of having understood and done what I wanted, for she smiled, while I exclaimed inwardly and triumphantly, "*εὕρηκα! εὕρηκα!*" I now felt that the first step had been taken successfully, and that this was the only really difficult one, because by continuing the same process by which she had become enabled to distinguish two articles, by two arbitrary signs, she would go on and learn to express in signs two thousand, and, finally, the forty and odd thousand signs or words in the English language.

"Having learned that the sign for these two articles, *pin* and *pen*, was composed of three signs, she would perceive that in order to learn the names for other things she had got to learn other signs. I went on with monosyllables, as being the simplest, and she learned gradually one sign of a letter from another, until she knew all the arbitrary, tangible twenty-six letters of the alphabet, and how to arrange them to express various objects: knife, fork, spoon, thread, and the like. Afterwards she learned the names of the ten numerals or digits; of the punctuation and exclamation and interrogation points, some forty-six in all. With these she could express the name of everything, of every thought, of every feeling, and all the numberless shades thereof. She had thus got the '*open sesame*' to the whole treasury of the English language. She seemed aware of the importance of the process; and worked at it earnestly and incessantly, taking up various articles, and inquiring by gestures and looks what signs upon her fingers were to be put together in order to express their names. At times she was too radiant with delight to be able to conceal her emotions.

"It sometimes occurred to me that she was like a person alone and helpless in a deep, dark, still pit, and that I was letting down a cord and dangling it about, in hopes she might find it; and that finally she would seize it by chance, and, clinging to it, be drawn up by it into the light of day, and into human society. And it did so happen: and thus she, instinctively and unconsciously, aided in her happy deliverance. After she had mastered the system of arbitrary signs, made by the various positions of the fingers used by deaf-mutes, and called dactylology, the next process was to teach her to recognize the same signs in types, with the outlines of the letters embossed upon their ends. Thus with types, two embossed with *p*, two with *n*, one with *e*, and another with *i*, she could, by setting them side by side in the quadrilateral holes in the blind man's slate, make the sign of *pen* or *pin*, as she wished; and so with other signs.

"The next process was to teach her that when a certain kind of paper was pressed firmly upon the ends of these types, held close together, and side by side, there would be a tangible sign on the reverse of the paper, as *pin* or *pen*, according to the position of the three types; that she could feel this paper, distinguish the letters, and so read; and that these signs could be varied and multiplied, and put together in order, and so make a book.

"Then she was provided with types having the outlines of the letters made with projecting pin-points, which, when pressed upon stiffened paper, pierced through, and left a dotted outline of each letter upon the reverse side. This she soon ascertained could serve for writing down whatever she desired, and be read by herself; and also could be addressed to friends, and sent to them by mail.

"She was also taught to write letters and words with a lead pencil, by the aid of the French writing-board, which is the most simple, most effective, and cheapest method ever yet invented. This apparatus is made out of a piece of stiff pasteboard of the size of a common sheet of letter-paper, and has grooved lines or channels, about the eighth of an inch deep, running, an inch apart, transversely across the pasteboard plate. This pasteboard is inserted between the two pages of a common sheet of letter-paper, and the first leaf is pressed with the forefinger into the grooves. This leaves depressions or channels, the upper and lower edge of which can be felt by the pencil-point, and this, a little pressed, leaves it marked with an *o*, or an *l*, or a *t*. The sides of the grooves also give to the paper which is pressed between them rounded edges, so that the pencil can slide upwards and downwards over and under them, and also be guided from left to right.

"It would occupy more space than can be spared here to explain how, after she had learned the names of substantive nouns, or names of things in the concrete, she came to understand words expressive of the various material or moral qualities thereof. The process was slow and difficult, but I was so aided by her native shrewdness and her love for learning new things that success followed. For instance, she knew that some girls and women of her acquaintance were very sweet and amiable in their tempers, because they treated her so kindly, and caressed her so constantly. She knew, also, that others were quite different in their deportment; that they avoided or repelled her, and were abrupt in their motions and gestures while in contact with her; and might be called, therefore, sour in their tempers. By a little skill she was made to associate in her mind the first person with a sweet apple, the other with a sour apple, and so there was a sign for a moral quality. This is a rough illustration; but it is hard to explain the process by which any children come to understand the names of things in the abstract, or moral qualities. Success came of faith, and patience, and reliance upon her having the native desire and capacity for acquiring a complete arbitrary language, which desire had now become quickened to a passion for learning new signs. Moreover, I was greatly aided from the start by young lady teachers, who became in love with the work, and devoted themselves to it with saintly patience and perseverance. Then great assistance was given by the blind pupils, many of whom learned the manual alphabet and took every opportunity of using it and conversing with Laura. Thus early in the process the material and moral advantages of language began to show themselves. Without it the girls could only manifest their interest in Laura, and their affection for her, as one does with a baby, by caresses, sugar-plums and other gifts, and by leading her up and down, and helping her in various ways. With it they began human intercourse through regular language.

"And so she went on, diligently and happily, for a score or more of years, until at last she acquired a large vocabulary of words, and could converse readily and rapidly with all deaf-mutes, and all persons who could use these signs. She could read printed books readily and easily, finding out for herself, for instance, any chapter and verse of Scripture. She could also read letters from her friends in pricked type, or by the Braille system of points. She could also write down her own thoughts and experiences in a diary; and could keep up a correspondence with her family and friends by sending to them letters in pencil, and receiving their answers either in pricked letters, which she could read by the touch, or letters written with ink or pencil, which would be read to her by some confidential seeing person.

"Thus was she happily brought at last into easy and free relations with her fellow creatures, and made one of the human family.

"During many years Laura passed most of her time in exercises such as those above described, new ones being devised as she proceeded. She spent as many hours daily in her studies and mental work as was consistent with her health; but all the rest of the time was given to gymnastics, or learning to handle domestic implements, as the broom, the dish-cloth, and the needle; to sew, to knit, to braid, to occupy herself in simple house-work, sweeping floors, dusting furniture, making beds; finally, to more difficult kinds of work, as crochet-work and the like.

"In all these things she succeeded so well, that she is now capable of earning a livelihood as assistant to any kind and intelligent housekeeper who would accommodate her work to Laura's ways.

"The method of instruction was of course novel, and the process long and tedious, extending over several years, until she came to be able to read and understand books in raised letters; to mark down variously shaped signs upon a grooved paper, and so write letters legible by the eye; to attain a pretty wide command of the words of the English language, to spell them out rapidly and correctly, and so express her thoughts in visible signs and in good English. To make all this fully understood by specimens of her style as she used the language of childhood, will require a good-sized volume; and I confine myself now merely to saying that in the course of twenty years she was enabled to do it all. She has attained such facility for talking in the manual alphabet, that I regret that I did not try also to teach her to speak by the vocal organs, or regular speech. The few words which she has learned to pronounce audibly prove that she could have learned more."

CHAPTER IX.

MEMORY AND IMAGINATION.

"You tell me it consists of images or pictures of things. Where is this extensive canvas hung up? or where are the numerous receptacles in which these are deposited? or to what else in the animal system have they any similitude? That pleasing picture of objects represented in miniature on the retina of the eye seems to have given rise to this illusive oratory. It was forgot that this representation belongs rather to the laws of light than to those of life; and may with equal elegance be seen in the camera obscura as in the eye; and that the picture vanishes for ever when the object is withdrawn."—DR. DARWIN, *Zoonomia.*

HITHERTO nothing special has been said concerning memory, although its existence has been necessarily assumed, and its nature indicated, in the foregoing pages. No mental development would be possible without it, for if a man possessed it not he would be obliged to begin his conscious life afresh with each impression made upon him, and would be incapable of any education. We cannot perhaps better define memory than, following Locke, as the power which the mind has "to revive perceptions which it once had, with this additional perception annexed to them, that it has had them before;" in other words, as the power or process by which that which has been once known is, when *re*presented to the mind, known as a previous mental experience, that is, is *re*cognised. When people speak of ideas being laid up in the memory, they of course speak metaphorically; there is no such repository in which ideas are stored up, ready to be brought out when required for use; when an idea which we have once had is excited again, there is simply a reproduction of the same nervous current, with the conscious addition that it is a reproduction—it is the same idea *plus* the consciousness that it is the same. The question then suggests itself, What is the physical condition of this consciousness? What is the modification of the anatomical substrata of fibres and cells, or of their physiological activity, which is the occasion of this *plus* element in the reproduced idea? It may be supposed that the first activity did leave behind it, when it subsided, some after-effect, some modification of the nerve element, whereby the nerve circuit was disposed to fall again readily into the same action; such disposition appearing in consciousness as *re*cognition or memory. Memory is, in fact, the conscious phase of this physiological disposition when it becomes active or discharges its functions on the recurrence of the particular mental experience. To assist our conception of what may happen, let us suppose the individual nerve-elements to be endowed with their own consciousness, and let us assume them to be, as I have supposed, modified in a certain way by the first experience; it is hard to conceive that when they fall into the same action on another occasion they should not recognise or remember it; for the second action is a reproduction of the first, with the addition of what it contains from the after-effects of the first. As we have assumed the process to be conscious, this reproduction with its addition would be a memory or remembrance.

Psychology affords us not the least help in this matter, for in describing memory as a faculty of the mind or the conservative faculty it does no more than present us with a name in place of an explanation. But we do get nearer realities when we go down to the organic aptitude which, in consequence of an action, there is to the recurrence of a similar action on another occasion. And physiology presents us with many illustrations of such organized aptitudes. Take, for example, the education of our movements: a designed movement is performed at first slowly and clumsily, and it is only by giving great pains to it and frequently repeating it that we acquire the skill to perform it easily and quickly; the aptitude thereto being at last so completely organized in the proper nervous centres that it may be performed without consciousness on our part, quite automatically. Thus it appears that memory in this case becomes less conscious as it becomes more complete, until, when it has reached its greatest perfection and is performed with the most facility, it is entirely unconscious. After which, if we are psychologists who are content to rest in words and forbear to pursue the facts which they denote, we must cease to speak of it as memory: it has become custom, or habit, or automatism. But if we go beneath words to the property of the motor nerve-centres whereby they react in a definite way to impressions made upon them, organically register their experience, and so acquire by education their special faculties, we perceive that we have not to do in the higher nerve-centres with fundamentally different properties of nerve element, but with different functions which depend upon the same fundamental property. Substitute the highest nerve-centres for the motor nerve-centres, and the complex idea for the complex movement, and what has been said of the latter is strictly true of the former; the idea, like the movement, is accompanied with less consciousness the more completely it is organized, and when it has been completely organized it takes its part automatically in our mental operations, being performed, as a habitual movement is performed, automatically. (1) The physiological condition of memory is, then, the organic process by which nerve-experiences in the different centres are registered; and to recollect is to revive these experiences in the highest centres, the functions of which are attended with consciousness—to stimulate, by external or internal causes, their residua, aptitudes, dispositions, or whatever else we may choose to call them, into functional activity. Stimulated from without, they constitute recognition, that is, cognition with memory of former cognition; stimulated from within, they constitute recollection.

It must be borne in mind, as Dr. Darwin remarked many years ago, that in dealing with memory we have to do not with laws of light, but with laws of life, and that the misleading notion of images or ideas of objects being stored up in the mind has been derived from our experience of the action of light upon the retina. If we would understand the laws of organization in the highest nerve-centres, we shall certainly do well to study organic processes generally; it would be not less absurd to attempt to understand the higher processes without giving attention to the lower, than it would be to attempt to build a house without taking pains to lay its foundations securely. It is a plain matter of observation that other organic elements besides nervous elements perpetuate impressions made upon them, which they may accordingly in a certain sense be said to remember; the virus of small-pox, for example, makes an impression upon all the elements of the body, which they never lose, although it becomes fainter with the lapse of time; in some unknown way it modifies their constitution so that ever afterwards their susceptibilities are changed. The scar which is left after the healing of a wound in a child's finger keeps the same relative proportion to the finger through life, growing as it grows; for the elements of the new tissue not only renew themselves particle by particle, and thus perpetuate it, but they extend it in relation with the growth of the surrounding parts. Perhaps the most remarkable example of the exceeding impressionability of organic element is afforded by the minute germ-cell or sperm-cell, which carries in its constitution not only the particular dispositions of the several tissues of the parent, but even, as there is good reason to believe, the particular mood of mind which prevailed at the time of its secretion. We need not brave the fire of psychological scorn by calling this retention of impressions *memory*, or care greatly what it is called, so long as due heed is given to the fact; but we may be permitted to perceive in it the same physiological process which, in the cortical layers of the cerebral hemispheres, is the condition of memory, and of habit in thought. Moreover, it may be fairly demanded of the psychologists that they be consistent, and that they no longer use the word memory to denote those mental processes which have been so completely organized that they take place without consciousness; if it be wrong, as they profess, to assume or imply an unconscious memory, it must be still more wrong to assume or imply an unconscious consciousness, as they sometimes do.

In any case, the foregoing considerations cannot fail to show how misleading it is to look upon perceptions as mere pictures of nature, and upon the mind as a vast canvas on which they are cunningly painted; the real process is one of organization, and is rightly conceivable only by the aid of ideas derived from the observation of organic development—namely, the fundamental ideas of Assimilation of the like and Differentiation of the unlike. Nowhere is it more necessary than in the study of memory to apprehend clearly that what we call mind is the function of a mental organization; for thereby we get rid at once of many empty discussions which have been carried on without definite result; as, for example, whether memory is a knowledge of the past, or a knowledge of the present with a belief of the past, and the like. Moreover, this conception of a mental organization is indispensable to the explanation of the manifold varieties of partial or general loss of memory which are produced by injury, disease, and decay of brain; for memory is good or bad according to bodily states, is impaired in various ways by disease, decays with the decay of structure in old age, and is extinguished with the extinction of life in the brain.

From of old two kinds of memory have been distinguished, according as the object remembered occurs to the mind spontaneously, or is voluntarily sought for; the former being known as *memory* proper, the latter as *recollection*. It is certain that we do recognise this difference, which common language attests, between that which is revived without any effort, and that which we endeavour to recover by an effort; and that men differ much, by virtue of natural capacities, both in memory and in power of recollection. No doubt much of the difference in both cases is due to the degree of attention which is given to the subject when it is first presented to the mind, but this will not account satisfactorily for all the difference which is observed; some persons being able to repeat with great ease a row of figures, a number of dates, or several lines of poetry, after reading them over once, while others fail to do so with equal success after reading them over many times. Extraordinary instances have been recorded of this exactness of memory for details reaching back to the earliest periods of life. I have seen an imbecile in the Earlswood Asylum for idiots who can repeat accurately a page or more of any book which he has read years before, even though it was a book which he did not understand in the least; and I once saw an epileptic youth, morally imbecile, who would, shutting his eyes, repeat a leading article in a newspaper word for word, after reading it once.* This kind of memory, in which the person seems to read a photographic copy of former impressions with his mind's eye, is not indeed commonly associated with great intellectual power; for what reason I know not, unless it be that the mind to which it belongs is prevented by the very excellence of its power of apprehending and recalling separate facts from rising to that discernment of their higher relations which is involved in reasoning and judgment, and so stays in a function which should be the foundation of its further development; or that, being by some natural defect prevented from rising to the higher sphere of comprehension of relations, it applies all its energies to the apprehension of details.† Certainly one runs some risk, by overloading the memory of a child with details, of arresting the development of the mental powers: stereotyping details on the brain, we prevent that further development of it which consists in rising from concrete perception to conception of relations. However, it must be allowed that there have been a few remarkable instances of extraordinary men who have combined a wonderful memory for details with the possession of the highest intellectual powers.‡

If we now proceed to examine closely the nature of recollection, it will be found that the difference between it and simple memory is not fundamentally so great as appears on the surface. When we voluntarily try hard to remember something which has been forgotten, and succeed in the end, the actual revival is done unconsciously and, as it were, spontaneously; for it is plain that if we were conscious of what we want we should not need to recollect it, inasmuch as it would already be in possession; and it is furthermore plain that a definite act of volition recalling it must imply a consciousness of it, inasmuch as it is impossible to will what we are not conscious of. Arbitrary recollection by an act of will is therefore nonsense. What we really do when we try to recollect is to apply attention to words or ideas which have, in our past experience, accidental or essential relations to, or associations with, the forgotten word or idea, voluntarily to keep these ideas active by making them consciousness, and to trust to their power of awakening into activity that which it is desired to recall; indeed, it is notorious that the best way of succeeding is, having held the related ideas energetically in attention for a time, to allow the thoughts to pass to other things, when the lost idea will, after a longer or shorter time—sometimes indeed after days—recur to the mind. The actual process of reproduction is therefore one of simple or spontaneous memory; we prepare the way for it by stimulating into action the related ideas, but we positively interfere with its success if, by continuing to keep them in attention, we do not permit them to do their work spontaneously; the reason of this being that we thereby, as set forth in a former chapter, hinder the propagation of their activity to other nerve-circuits. We shall understand this the better if we realize that consciousness is the *result* of a certain activity of idea, not driven to it but drawn by it, and get rid of the metaphysical notion that it is some mysterious power which we direct voluntarily to the idea in order to make it active.

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* I have been informed of a similar case in which the person could repeat *backwards* what he had just read.

† We know that the convolutions consist of several layers or strata, the higher of which may be presumed to have higher functions than the lower; it is possible that in the defective brain of the idiot these higher strata of cells and fibres may be imperfectly developed or altogether wanting.

‡ Macaulay may be cited as a remarkable instance; for in him great intellectual powers were associated with an extraordinary memory for words, dates, facts, &c.

It will not be amiss, before passing from this subject, to take note of and to ponder that certainty which, in trying to recollect something, we have of our possession of what we are thus striving to regain consciously, though we are not conscious what it is. We have the clearest conviction that, although we have forgotten it, we still have it and may recover it. How comes it to pass that we are so sure of the existence of that of which we are not conscious? In the first place, it would appear to supply an argument in support of the theory that something has been left behind in the nerve-circuit ministering to the forgotten idea, in other words, retained by it, which differentiates it from other nerve-circuits, disposes it to a repetition of its former activity, and produces the conviction of a latent possession, even when it is not active, or at any rate not active enough to awaken consciousness. In the second place, it must be remembered that the forgotten idea had associations with other ideas, which are really part of its meaning; it may well be, therefore, that when these are active and occupy the attention, while it remains inactive and below the horizon of consciousness, there is a tendency or sort of effort to reopen the former paths of association, in order to their completeness—to make the circuit, so to speak; and that it is the consciousness of this tendency or effort which gives rise to the certainty which we have of something forgotten. Certain it is, that when a stimulus excites one of two movements which have taken place together or in succession on former occasions, there is a tendency, when the stimulus is powerful or continued, to the reproduction of the associated movement; there is a diffusion of the stimulus along the accustomed path to the associated motor centres, and a synergy of movements is the result. A piece of poetry which has been thoroughly learnt may be repeated mechanically, as a tune may be whistled, when the proper verbal movements have been once started; indeed, the repetition in such case is most successful when consciousness is not too much occupied with it; for it frequently happens, if we think about the words which we are repeating, that we become uncertain and forget, and are obliged, in order to succeed, to begin again and to allow the succession of movements to go on automatically. We impede the operation of the spontaneous memory, upon which we really depend, when, by maintaining the activity of a word in consciousness as attention, we hinder the propagation thereof to the associated nerve-circuits.

When a person who is conscious of an idea is striving to revive a related idea which he has forgotten, he presents an example of memory in the making; for he is striving to revive the yet incomplete organic union between them, which was the result of the original apprehension of their relations, and which, when complete, will cause the one idea to recall the other instantly and without the least effort, just as a single sensation of an object at once revives the cluster of sensations which are combined in the perception of it. The process of intellectual development consists in the mental organization of related ideas, as internal representatives of external relations in nature, and in making this organization so complete that a number of associated ideas shall act like a single idea, being combined into a complex product and recalled instantly and without conscious effort, just as a complex movement is. Then the memory is so complete that we must cease to call it memory, because it is unconscious. In fact, spontaneous recollection is at an end when involuntary memory begins, and involuntary memory merges gradually into a reproduction of former mental experiences which is as completely automatic as the habitual movements of our daily life. And well it may be; for the same organic property of nerve element—indeed, I might say, the same fundamental property of organization—is at the bottom of both.

Thus much concerning the nature and function of memory. Upon its basis rests the possibility of mental development, in which there are, as we have already seen, the organic registration of the *simple* ideas of the senses; the assimilation of the like in ideas which takes place in the production or evolution of *general* ideas; the assimilation of the properties common to two or more general ideas into an *abstract* idea; the special organization, or differentiation, or discrimination, of unlike ideas; the organic combination of the ideas derived from the different senses into one *complex* idea, with the further manifold combinations of complex ideas into what Hartley called *duplex* ideas. In fact, no limit is assignable to the complexity of combinations which may go to the formation of a compound idea. Take, for example, the idea of the universe. But how comes it to pass that a new imaginative creation of the mind, to which nothing in nature answers, is effected? By the same process fundamentally as that by which our general and abstract ideas are formed. For when we consider the matter, it appears that there are no actual outside existences answering to our most abstract ideas, which are, therefore, so far new creations of the mind; in their formation there is a blending or coalescence of the like relations in two concrete ideas—the development of a *concept*, there is, as it were, an extraction of the essential out of the particular, a sublimation of the concrete; and, by the creation of a new world in which these essential ideas supersede the concrete ideas, the power of the mind is most largely extended. Now, although there are no concrete objects in nature answering to these abstract ideas, yet these are none the less, when rightly formed, valid and real subjective existences expressing or signifying the essential relations of things, as the flower which crowns development expresses the essential nature of the plant. Thus it is that we rise from the idea of a particular man to the general idea of man, and from that to the abstract idea of virtue as a quality of man; so that for the future we can make use of the abstract idea in all our reasoning, without being compelled to make continual reference to the concrete.* Herein, be it remembered again, we have a process corresponding with that which ministers to the production of our motor intuitions; the acquired faculty of certain co-ordinate movements by means of which complicated acts are automatically performed, and we are able to do, almost in the twinkling of an eye, what would cost hours of labour if we were compelled on each occasion to go deliberately through the process of special adaptation, is the equivalent, on the motor side, of the general idea by which so much time and labour are saved in reasoning: in both cases there is an internal development in accordance with fundamental laws, and the organized result is, as every new phase of development is, a new creation. Creation is not by fits and starts, but it is continuous in nature.

These considerations are of the utmost importance in respect of the nature of Imagination, which must ever be incomprehensible on the mischievous assumption of ideas being pictures or images of things painted on the mind by memory. Though imagination is certainly dependent on memory, there is unquestionably something more in imagination than memory only; it is not *reproductive* only, as memory is or should be, but *productive;* it brings back the old, but with a new form—that is, is productive as to form, reproductive as to material. When any one affirms that he can imagine something—as, for example, some animal of which he has not had experience, what he does is to combine into one form certain selected characters of different animals of which he has had experience; creating in this way, as nature is continually doing, new forms out of old material. When the artist embodies in ideal form the result of his faithful observation, he has, by virtue of that mental process through which general ideas are formed, abstracted the essential from the concrete, and then by the shaping power of imagination given to it a new embodiment. In every great work of art, poem or painting, there is thus an involution of the universal in the concrete: it is pregnant in its meaning, yielding a wide range to the action of another's imagination when he contemplates it. If it is merely a copy or exact reproduction of nature, it is clever artifice rather than great art, and excites a feeling of gratified interest at the skill displayed rather than vague and elevating emotions of sympathy with a deep truth embodied in beautiful form. So it is that high art does not express anything *essentially* evanescent: it confers on the moment the steadfastness of eternity, representing the "shows of nature frozen into a motionless immortality." The man of science, who unlocks the secrets of Nature by means of observation, experiment, and reflection, thus systematically training his mind in conformity with Nature by exact interrogation and faithful interpretation of her works, foresees future combinations, and when he proceeds to react upon nature, is enabled, by means of a scientific imagination thus carefully cultivated, to construct wonderful works of art that are truly an advance upon, or a development of, nature—new creations; forming combinations in harmony with these real and essential relations of things which he has by patient and sympathetic observation made a part of the furniture of his mind, he creates something which is a result of the *nisus* of evolution working in him, a progress of nature through him, and which serves ever afterwards to inform, elevate, and better mankind.

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* Not overlooking, as so many do, that the meaning of the general or abstract is to be sought in the concrete, not the interpretation of the concrete in the general or abstract. If we have any doubt about the meaning of an abstract idea, or doubt whether it has any meaning, we ought to trace it downwards to its root in perception, and discover its meaning there; above all we ought not to convert it into an objective entity, and then to spin webs of argument concerning it as the schoolmen did.

What else then, fundamentally, is the true imagination but the *nisus* of nature's organic development displaying itself in man's highest function? It is the evolution of the mental organization. What is human art but nature developed through man; nature as it has been moulded by the infused spirit—the inspiration—of man? Informed of nature, in turn he informs nature. There is going on a recreation of nature by human means, but nature makes the means.* The productive or creative power of Imagination, which seems at first sight to be irreconcilable with knowledge gained entirely through experience, is then at bottom another, though the highest, manifestation of that force which impels organic development throughout nature; and the imagination of any one either creates truly, or brings forth abortions and monstrosities, according as the mind is well stored with sound knowledge and has true concepts, or as it is inadequately furnished with knowledge and has erroneous concepts—according, in fact, as the individual is or is not in harmony with nature.

In order to the full function of imagination, in order, that is, that it may combine into new form, according to higher laws, the ideas and feelings which have been furnished by the senses and the bodily organs—it is plainly indispensable that the several pre-necessary mental operations should be performed correctly: it is essential, in fact, that there should be, in the first place, accurate *perception*—that the mind or brain should respond truly and adequately to impressions; secondly, that there should be accurate *memory*, the mind retaining or registering accurately what has been received; thirdly, that there should be good *recollection*, the mind being able to reproduce and use with ease and completeness what it possesses; and that, lastly, the mind or brain should be endowed with that *productive* power by which it is enabled to combine and create. Though a person may be capable of performing well the first three mental operations, if he have not also productive power, he is incapable of the highest imagination; he lacks the highest function of mind. He may be able to gather material together, but he cannot truly combine it, according to mental laws, into a true creative product; for production is not merely a binding together of material, but an organic combining and development of it. As Wieland aptly remarked, the eyes of Juno, with the nose of Apollo, the brow of Minerva, and the smile of Venus, would form an absurdity, not a masterpiece of fancy; it would be like a mixing together of several chemical elements that would not combine, not a combination of them into a new product having properties unlike those of its constituents.

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* "Yet nature is made better by no mean,
But nature makes that mean; so, over that art,
Which, you say, adds to nature, is an art
That nature makes . . . .
. . . .
. . . . This is an art
Which does mend nature—change, rather: but
The art itself is nature."—*Winter's Tale.*

When we look back through the lower forms of mind we find that this productive or plastic power increases with the increase of mind. So far as we can judge, the imagination of animals is mainly, if not entirely, reproductive; when they dream, as dogs evidently sometimes do, it is presumably memory rather than imagination which is at work. The imagination of savages is certainly much more limited to reproduction than that of highly civilized persons; it is occupied with the ideas of perception, or with such incongruous and often grotesque mixing together of ideas as may serve for an explanation of natural phenomena that are not understood. The imagination of young children is very much like that of savages, and they are pleased and satisfied with the same kind of fabulous explanations of phenomena. In dreaming, the imagination commonly runs riot, wildly mixing together incongruous ideas into the most absurd forms, but still evincing its wonderful shaping power in the vivid dramas which it represents. In the man of genius, whose mind is in intimate sympathy with the laws of nature and strong with their strength, imagination shapes truly, for it is nature working in him; it is the highest display of organic evolution, and, like nature, works unconsciously. ([2])

Although there is something more in imagination than perception and memory, which are its necessary foundations, it may be remarked that many times much of what we call memory is really imagination. When we think to recall the actual, the concrete, it is often the ideal, the general, that we reproduce; and when we believe that we are remembering, we are often *mis*remembering, being swayed by the feelings of the moment which colour our remembrance, and unable to reproduce the feelings of the past under which we had the actual experience. How much of perception too is *actually* imagination! The past perception unavoidably mingles in the present act, prevents us often from discriminating minute differences which exist, and thus causes us to perceive wrongly or observe incorrectly. What shall be admitted as a *fact* in scientific observation depends entirely upon the observer's previous knowledge and training. So strong is the disposition to assimilate a previous observation with a past perception, to blend together the like in two ideas, that it is the easiest thing in the world to overlook those special differences which demand a discrimination or organic differentiation; there is, indeed, as great a danger of hasty generalization in perception as there is in reasoning. That which in a present perception is the like of something in a former perception easily stimulates the same nervous current, which accordingly occupies attention, to the neglect or overlooking of that in which the perceptions are unlike; whence it frequently happens that a misperception occurs, and that facts not the same are declared to be the same. It is always a pleasure when a new experience blends with an old one; if a new observation will not easily assimilate with existing ideas, there is a feeling of dissatisfaction and of positive discomfort, and one is apt to pass the unwelcome fact by. But if a proper mental training prevents such neglect, the fact is deliberately appropriated or registered as a special fact, although small satisfaction is felt in the martyrdom of thus registering it, isolated as it appears; after a while, however, other observations cluster about it, some blending with it, others connecting it with ideas to which it seemed entirely unrelated, until this pariah of the mind is found perhaps to bridge over a gap in knowledge, and organically to unite distant ideas. It may be supposed, indeed, that while this is going on its nervous substratum is forming its organic connections in the plexuses of the convolutions. The habit of observing accurately, of carefully noting minute differences, and of scrupulously registering them so as to effect an exact internal correspondence with external specialities, is indispensable to the true cultivation of mind.

When a past perception of a fact vitiates a present perception, it is hardly correct to ascribe the erroneous perception to imagination; it is really a false perception arising from imperfect observation and hasty generalization; but when the fact that has been erroneously or imperfectly observed is used in inference to warrant an anticipation or prediction, then certainly imagination is at work, and future observations are likely to be falsified by the erroneous anticipation or theory of what will be seen.

That is what we mean to imply when we say of an untrustworthy scientific observer that he resorts to his imagination for his facts; his present observation is vitiated by the perverting influence of an incorrect theory based upon imperfectly observed facts. Accurate perception and exact memory are the fundamental basis of sound reasoning and imagination. As we perceive more accurately, so shall we remember more correctly, judge more soundly, and imagine more truly. The habit of hasty and inexact observation, the unwarranted blending of residua that are not truly like, is necessarily the foundation of a habit of remembering wrongly; and the habit of remembering wrongly is of necessity the cause of incorrect judgment and of erroneous imagination: exact internal correspondence and external relations being the basis of an imagination true to nature,—in other words, of a true organic mental development. For these reasons, "the whole powers of the soul may," as Hartley observes, "be referred to the memory, when taken in a large sense. Hence, though some persons may have strong memories and weak judgments, yet no man can have a strong judgment with a weak original power of retaining and remembering."

If the imagination have not a sound basis in habits of accurate observation, it degenerates into fancy; a term which, though originally it was considered to mean the same thing as imagination, is now used to denote a well-founded difference.* Fancy represents the productive or creative power of imagination working without that due restraint of law which is imposed upon its operation by habits of accurate observation, and without that proper and sufficient material of facts which such observation furnishes; consequently it wildly or whimsically yokes together by means of accidental coincidences things that have no essential relations to one another. The productive power of imagination can create *form*, but cannot create the material with which it must work; for that it must go to nature; nor will it create true forms unless it be itself *informed* by nature. Yellow and blue mixed together produce green; "but he who has never seen this colour," says Feuchtersleben, "can never create it in his fancy." Thus, in regard to the highest mental function as in regard to the lowest, we perceive that man is a complex medium, through which impressions are translated into action; he is a complex and intricate mechanism of so-called reflex function.

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* Imago, image, imagination, were once synonymous with φάντασμα, phantasm, fancy; it is interesting to note how the latter have now received their special meanings, phantasm being an illusion or hallucination, and fancy a riotous imagination.

As organic growth and development take place in obedience to the laws of nature, and yet constitute an advance upon them, so it is with the well-cultivated or truly developed imagination, which brings together images from different regions of nature, yokes them together by means of their occult but essential relations, and, thus making the whole one image, gives a unity to variety—displays the one in the many: there is an obedient recognition of nature, and there is a developmental advance upon it. This *esemplastic* faculty, as Coleridge, following Schelling, named it, has been fancifully supposed to be indicated by the German word for imagination, namely, *Einbildung*, or the *one-making faculty*.* Its highest working in our great poets and philosophers really affords us an example of creation going steadily on as a natural process; and creative or productive activity is assuredly the expression of the highest mental action: whosoever has such capacity has more or less genius; whosoever has it not will do nothing original, though he work never so hard. What an amount has been unwisely written by the sedulous followers of a so-called inductive philosophy in disparagement of imagination and in favour of simple observation! "Men should consider," says Bacon, "the story of the woman in Æsop, who expected that with a double measure of barley her hen would lay two eggs a day; whereas the hen grew fat and laid none." It were as wise in a man to load his stomach with food which it cannot digest, as to load his mind with facts which it cannot digest and assimilate. It is in the great capacity which it has of assimilating material from every quarter, and of developing in proportion, that the superiority of genius consists; and it is in the excellence of its creative imagination, whether poetic, artistic, philosophic, or scientific, that its superior energy is exhibited.

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* More correctly *Ein* for *en* (in), and *Bildung* (formation,)—internal image, *i.e.* imagination.

Because the least things and the greatest in Nature are indissolubly bound together as equally essential parts of the mysterious but harmonious whole, therefore the intuition into one pure circle of her works by the high and subtile intellect of the genius contains implicitly much more than can be explicitly displayed in it; and therefore it comes to pass at times that, in the investigation of a new order of events by an intellect which is in genial sympathy with nature, the law of them explicitly declares itself as by a flash of intuition, after comparatively few observations. The imagination successfully anticipates the slow results of patient and systematic research, flooding the darkness with the light of a true interpretation, and thus illuminating the obscure relations and intricate connections. Therein a well-endowed and well-cultivated mind manifests its unconscious harmony with nature. The brightest flashes of genius come unconsciously and without effort: growth is not a voluntary act, although the gathering of food is.

Certainly the intuition of truth can never be the rule amongst men, inasmuch as the genius capable of this rapid and brilliant intuition, so far from being common, is a most rare exception amongst them. And the result, however brilliantly acquired, can never be safely accepted as lasting, until it has been further subjected to the tests of observation, experiment, and logical reasoning,—until it has undergone verification. The man of genius who has revealed a great truth may perhaps, on some other occasion, promulgate an equally great error. Not, however, is this likely to happen often: for a well-trained intellect is truly a most delicate, potent, and finished instrument, which has been fashioned with great pains and skill, and which, when applied to the investigation of any department of nature, places its possessor at an enormous advantage over one who is not so gifted; not otherwise than as one who uses a microscope or a telescope has vast advantages over him who uses his naked eye only. Happily his errors, if they are made, are indirectly most useful; for the experiments and observations provoked and directed by them, and prosecuted for the purpose of displaying their instability, often lead to valuable discoveries. Mischief is undoubtedly wrought by the rash promulgation of ill-grounded theories on the part of those who have neither superior original capacity, nor a mind well stored with the results of observation, nor an imagination properly cultivated. It is the ignorant only, however, whom such persons deceive: those who possess an adequate knowledge of the subject can usually detect in the unwarranted theory the exact amount of knowledge which its author has had, and the character of the defect in the reasoning by which it is supported.

Those who take a philosophical view of things, and look upon the progress of human knowledge as a development which is going on continuously through the ages, will find it conformable to their experience of every other form of vital growth that there should be, coincidently with advance, a retrograde metamorphosis, degeneration, or corruption of that which is not fitted for assimilation, and which is ultimately rejected; for as the body dies daily as the condition of its life, so false theories and corrupt doctrines are conditions of the progress of knowledge. In the growth and development of the body there is a correlative degeneration or retrograde metamorphosis of organic element going on—a daily death in strict relation with the activity of life; so likewise in the organic growth of thought through the ages, there is a corresponding decay or corruption of erroneous doctrines—a death of the false in strict relation with the growth of the true; thus healthy energy throws off effete matter, which, in the very act of undergoing decay, gives up force that is available for the development of the higher doctrine which supersedes it. That men should evince a distrust of hasty generalization, and an unwillingness to accept new doctrines, is a healthy manifestation of the self-conservative instinct of their nature; for this aversion from new things prevents the human mind from being led astray by every vain and windy doctrine, opens the way for criticism and verification, and thus in the end promotes a sound development. Not in the individual, however, where so much active change takes place in so short a time, will the regular corruption and decay of false doctrines be clearly perceived, but in the historical development of the race, where the gradual evolution of mind may be observed and traced in its successive stages.

Thus much concerning memory and imagination, the examination of which reveals, better perhaps than the analysis of any other of the so-called mental faculties, the complex organization which mind really is. It remains only to add, that the manifold disorders to which memory is liable illustrate in the most complete manner its organic nature. Its disorders are numberless in degree and variety; for not only every degree of dulness, but every variety of partial loss, as of syllables in a particular word, of certain words, places, names, is met with in particular cases. So various and numerous are its possible defects, that it has not yet been practicable to reduce them to any system, although it is probable that a careful classification of them would be a most useful contribution to the construction of a mental science. All that we can at present conclude from them is, first, that memory is an organized product; and, secondly, that it is an organization extending widely through the cortical layers of the cerebral hemispheres. It is easy to observe that differences exist in different persons in the character of the organic function which ministers to memory: one man, for example, has a good memory for particular facts, but is no way remarkable for reasoning power, or is even singularly deficient therein—the registration of the concrete impressions taking place with great ease and completeness, but the further digestion of the residua not being accomplished; another, on the other hand, has no memory for particular isolated facts, —they must have some relation to ideas already appropriated, or must fall under some principle, if he is to recollect them; in this case the digestion of residua is well effected, so that there exists a great power of generalization. The latter is the memory of intellect; the former, as I have already pointed out, is not unfrequently the memory of idiots.

It is well-known that memory is greatly affected by bodily states: it differs much at different times; and in a state of complete bodily exhaustion from temporary causes it may sometimes become a complete blank for a time, being restored to its accustomed function with the restoration of bodily vigour. These occasional variations in its function are of no great moment; they merely prove that memory, like any other bodily function, is well and easily, or ill and painfully, performed according to the state of the general health. But it must also be borne in mind that some flaw in the memory, some breach in its exquisite organization, is one of the first indications of a disorder or degeneration of the nerve element of the cortical layers. Its slight, early affections are very apt to be overlooked, forasmuch as they do not reveal themselves in a conscious inability to remember something, but in an unconscious deterioration of the highest mental functions, and especially of the moral sense. The most delicately organized residua, representing the highest acquisitions of organic evolution, are here the first to attest by their sufferings any interference with the integrity of nerve-element, just as disorders of the most delicate and complex associated movements of the spinal cord are the first to declare the commencing degeneration of its centres. There is a decomposition or undoing of that which constitutes the latest and highest mental development—an analysis of it, so to speak; disease rudely unravelling that which has been intricately and delicately woven into a complex woof of associated nervous plexuses. Long before there is any palpable loss of memory in insanity, even before an individual is recognised to be becoming insane, there is a derangement of his highest reasoning and of his moral qualities; his character is seen to be more or less altered, though what the exact change is cannot perhaps be described in words; as it is said, "he is not himself." If the degeneration of nerve element proceeds we witness successively every stage of declension in the disorder of the complex organization of the memory; namely, manifest perversion of the higher social feelings, next greater or less destruction of the organic connexions of ideas, whence follows incoherence of thought, and, finally, general forgetfulness, declining into complete abolition of memory.

It is not difficult to understand how it is that the old man sometimes has a tenacious memory of the past, and reasons tolerably correctly with regard to it, when he cannot duly appropriate and rightly estimate the present. The brain, like every other organ of the body, suffers a diminution of power of activity with the advance of age; it is less supple, its ideas, like the movements which it dictates, being performed slowly and stiffly; it reacts to impressions with less and less vigour and vivacity, and there is less and less capacity to assimilate the influence of them, so that there ensue dulness of perception and an incorrect appreciation of events. Meanwhile, however, the past is a possession which is incorporated in the organic nature of the brain, and may be sufficiently remembered, though perhaps with less vivacity than formerly, when the latest impressions have been obliterated by "decay's effacing finger." It is easy, again, to perceive how it is that children, like animals, live almost entirely in the present; they have no store of ideas organized in the mind which can be called into activity to influence the present idea, and they react directly to the impressions made upon them. The best possible evidence of the gradual process of mental organization is indeed afforded by the mental phenomena of young children; for, the residua of impressions not being completely organized, their memory is fallacious, and, a firm organic association between ideas not being established, their discourse is incoherent.

The old man and the child both fail in judgment: the former, because he has forgotten more or less of the past, and has lost the standard by which to measure the present perception, or because he cannot perform accurately the present perception, and measures it entirely by the past; the latter, because it has not yet any past. By the necessity of the case almost, an old man becomes conservative and the *laudator temporis acti;* for the evolution of events goes on when his nature has ceased to assimilate and develop; he has accordingly no sympathy with them, shrinks from contact with them, and querulously brands as revolutionary what is truly *evolutionary*. It were a grievous thing if old men did not die; for in that sad case the world's movement onwards to where it is going would be very sluggish, if it were not actually arrested. How different with the youth! The curtain of life rises, its illusions fascinate him, and he is enchanted with all he sees; his nature expands trustfully and joyfully, and though he may often mistake fleeting shows for lasting truths, and come to no little sorrow thereby, yet he assimilates, grows, and develops. Nature lures him into young enthusiasm of faith and work, and by the time he finds her out in age dispenses with him.

Lastly, it will not be amiss to bear in mind, in regard to the organic nature of memory, that we cannot well remember pain. It is certainly possible to remember that we have suffered a particular pain; but vividly to recall the pain, as we can recall a definite idea, is not possible. And why? Because the idea is an organized product which abides, while the disorganization or disturbance of nerve element which pain implies passes away with the restoration of the integrity of the nerve centre. To recall an idea is to reproduce the same nervous current which was experienced on the first occasion, to the recurrence of which there is an organic aptitude. To recall a pain as we actually felt it would be to reproduce the conditions of disorganization which accompanied it; and that we cannot do by an effort of will. For the same reason, we cannot easily or adequately recall a very powerful emotion in which the idea or the *form* has been almost entirely lost in the commotion—where, in fact, the storm among the intimate elements has been so great as to be destructive of form: Shakespeare's words, "formless ruin of oblivion," admirably expressing the state of things. When we do strive to bring to mind a particular sensation or emotion, it is by vivid representation of its cause, and consequent secondary excitation of it: we remember the idea, and the idea thereupon generates the emotion or the sensation; though seldom in so intense a degree as when this was actually experienced. But the sensation of pain is a different matter from the sensation of one of the senses; it is the outcry of suffering nerve element, and cannot commonly be generated by an idea; it is not the result of organization, but the token of disorganization. How, then, should it be accurately remembered?

NOTES.

[1] (*p.* 514).—"The truth that memory comes into existence when the connections among psychical states cease to be perfectly automatic is in complete harmony with the obverse truth, illustrated in all our experience, that as fast as the connections of psychical states which we form in memory become, by constant repetition, automatic, they cease to be part of memory. We do not speak of ourselves as remembering those relations which become organically, or almost organically, registered; we remember those relations only of which the registration is not yet absolute. No one remembers that the object at which he is looking has an opposite side; or that a certain modification of the visual impression implies a certain distance; or that the thing which he sees moving about is a living animal. It would be a misuse of language were we to ask another whether he remembers that the sun shines, that fire burns, that iron is hard, and that ice is cold. . . . . And similarly, though, when a child, the reader's knowledge of the meaning of successive words was at first a memory of the meanings he had heard given to them; yet now their several meanings are present to him without any such mental process as that which we call remembrance."—HERBERT SPENCER, *Principles of Psychology*, p. 551.

[2] (*p.* 527).—Jean Paul Richter, in one of his Letters, says: "The dream is an involuntary art of poetry: and it shows that the poet works more with the bodily brain than another man. How is it that no one has wondered that in the detached scenes of dreaming, he puts in the mouth of the actors the most appropriate language, the words most exactly characteristic of their nature: or rather that

they prompt him, not he them? The true poet even is in writing only the listener, not the language-teacher of his characters. . . . . Victor's observation that the opponent of his dreams often put before him more difficult objections than a real bodily one, may be made of the dramatist, who can in no manner be the spokesman of his company without a certain inspiration, though he is at the same time easily the writer of their parts. That dream-forms surprise us with answers with which we ourselves have inspired them is natural; even when awake every idea springs forth suddenly like a spark of fire, though we attribute it to our attention; but in dreams we lack the consciousness of attention, and we must thus ascribe the idea to the figure before us, to which also we ascribe the attention." Again:—"Das Mächtigste in Dichter, welches seinen Werken die gute und die böse Seele einbläset, ist gerade das Unbewusste." —*Aesthetik.*

Carlyle, whose writings exhibit in a marked degree the influence of Jean Paul and Goethe, says of Shakespeare:—"Shakespeare is what I call an unconscious intellect; there is more virtue in it than he is himself aware of. His dramas are products of Nature, deep as Nature herself. It is Nature's highest reward to a true, simple, great soul, that he gets thus to be a *part of herself.* Such a man's works, whatever he with utmost conscious exertion and forethought shall accomplish, grow up withal *un*consciously from the unknown deep in him, as the oak-tree grows from the earth's bosom, as the mountains and waters shape themselves."

Dr. Brown (*Philosophy of the Mind*, p. 200), when enumerating what he calls the Secondary Laws of Suggestion, lays much stress on constitutional differences in individuals—the differences of Genius, Temper, or Disposition. The *tendencies* in some minds are wholly to suggestions of *proximity;* in other minds there is a powerful tendency to suggestions of *analogy.* It is in this latter tendency to the new and copious suggestions of analogy that the distinction of genius appears to consist; a mind in which it exists is necessarily inventive; "for all to which we give the name of invention, having a relation to something old, but a relation to that which was never before suspected or practically applied, is the suggestion of analogy." There would be nothing new if objects were to suggest only, according to proximity, the very objects that had co-existed with them; but there is a perpetual novelty of combination, when the images that arise after each other, by that shadowy species of resemblance which we are considering, are such as never existed before together or in immediate succession. Hence the rich figurative language of poetry—the expressions of resemblances that have arisen silently and spontaneously in the mind; hence the discoveries and inventions of science, &c. He goes on, too, to point out that this novelty of combination in imagination cannot depend upon the will. It is absurd, he says, to suppose that we can will directly any conception, since, if we know what we will, conception must be already a part of consciousness.

"Hence, in proportion as the memory is enriched and provided with materials, in the same proportion the rational mind, if backed by a happy genius, will be able skilfully, felicitously, and approximately and agreeably to the truth, to distribute its analysis into series, to adjust and conclude them, of many analytic conclusions again to form new analyses, and in the end to evolve its ultimate analyses."—SWEDENBORG'S *Animal Kingdom*, vol. ii. p. 348.

In a note he adds—"This is corroborated by the common opinion, that the knowledge and intelligence of an individual are in proportion to the furniture of his memory. But it does not follow from this, that a powerful memory is always accompanied with ability, or by an understanding of equal grasp. For the faculty of reducing the contents of memory to order is a fresh intellectual requisite. An edifice is not built simply by the accumulation of implements, bricks, tiles, and the materials. These and skill must be tasked to put all things together in their places."

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